STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO

9 March 1989

COMMISSION HEARING

IN THE MATTER OF:

Application of Phillips Petroleum Company for salt water disposal, Roosevelt County, New Mexico.	CASE 9511

BEFORE: William J. Lemay, Chairman
William M. Humphries, Commissioner
Erling Brostuen, Commissioner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Division:	Robert G. Stovall Attorney at Law Legal Counsel to the Division State Land Office Bldg. Santa Fe, New Mexico
For Phillips Petroleum Company:	W. Thomas Kellahin Attorney at Law KELLAHIN, KELLAHIN & AUBREY P. O. Box 2265 Santa Fe, New Mexico 87504
For Ensearch:	William F. Carr Attorney at Law CAMPBELL and BLACK P. O. Box 2208 Santa fe, New Mexico 87501

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E X H I B I T S

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MR. LEMAY: Case Number 9511.

MR. STOVALL: Application of Phillips Petroleum Company for salt water disposal, Roosevelt County, New Mexico.

MR. LEMAY: I'll call now for appearances in Case Number 9511.

MR. KELLAHIN: Mr. Chairman, Gentlemen of the Commission, my name is Tom Kellahin. I'm a Santa Fe attorney with the law firm of Kellahin, Kellahin & Aubrey. I'm appearing on behalf of the applicant, Phillips Petroleum Company.

MR. LEMAY: Thank you, Mr. Kellahin.

Mr. Carr.

MR. CARR: May it please the Commission, my name is William F. Carr, with the law firm Campbell & Black, P. A., of Santa Fe. We represent Enserch Exploration, Inc. in opposition to the application, and I have two witnesses.

MR. LEMAY: Thank you. How many witnesses to you plan to put on?

MR. KELLAHIN: Two, Mr. Chairman.

MR. LEMAY: Are there any other appearances in Case Number 9511?

Will the witnesses please, please stand and raise your hand and be sworn in? Let's do it all at once, so we can get them all.

(Witnesses sworn.)

MR. LEMAY: You may be seated.

Mr. Kellahin.

MR. KELLAHIN: Thank you, Mr. Chairman.

Mr. Chairman, Phillips Petroleum Company seeks the approval of the Commission on its salt water disposal well. We're going to be dealing in the South Peterson Field of Roosevelt County, New Mexico, which was originally discovered sometime in 1978.

The discovery well was drilled by Enserch Exploration. I believe that company is now called E. P. Operating Company. If I become confused and use those names interchangeably, I intend to mean the same company during the course of continuous operation.

The original field was developed by a discovery well that E. P., or Enserch, found in this area as a result of a farm out of acreage held by Phillips Petroleum Company. That explains some of the acreage position you'll see on what we'll subsequently be

introduced as Exhibit Number Four, and that's the big display next to the speaker rostrum.

The red acreage is the Phillips acreage and the white acreage, to most extent, represents the Enserch, or the E. P. Operating acreage.

There are two players in the pool, E. P. and Phillips.

Subsequent to the discovery further wells were drilled and ultimately came to the Commission, Enserch as well as Phillips, and asked the Commission to establish 80-acre spacing well locations for the development of what turned out to be an active water drive oil reservoir. We're dealing with Fusselman production. You will hear today the geologic terms Fusselman and Montoya used. In this particular pool there is no Montoya production. There's a geologic nomenclature whereby the Montoya is just below the Fusselman but there is no barrier, no separation, in our opinion.

The structure in the South Peterson Field is such that the better production lies to the southern end and as we move north, we get lower in the structure and ultimately move out of the South Peterson Field, and as you look at the display and you get to the point of the display where you approach the upper north of the circle scribed on Exhibit Four, we've moving into the

-- another reservoir. The reservoir to the north is called the Peterson; I believe it's also Penn or Fusselman production, but there is physical separation.

In 1981 Enserch applied for the use of a well in this area for disposal purposes and the witnesses are going to be discussing the facts and circumstances surrounding the reservoir at the time that the Enserch Rader Well in Section 32 was a subject of a hearing in 1981, and that's shown by the green arrow.

That becomes one of the issues for you to resolve, is -- is to remember the factual situation in 1981.

My witnesses will contend, and they believe after careful and thorough geologica and engineering, that there are material differences in the reservoir between 1981 when the Commission denied Enserch the opportunity to use this well for disposal purposes, and the facts and the circumstances in the reservoir that exist now for us to utilize what is known as the Lambirth A No. 6 Well, shown by the orange arrow, and that is the proposed disposal well for this hearing.

I don't propose to tell you all the facts that you're going to hear this morning, but I anticipate there are a number of key issues that we would request that you note, so that as the testimony unfolds

you'll understand that we believe those to be important.

One of the key areas of dispute is to determine precisely where the oil/water contact is in this reservoir. It is our contention and our witnesses believe that that oil/water contact is significantly above the perforated intervals for disposal in the Lambirth A No. 6 Well.

In addition, we believe after careful review and study that there remains no current Fusselman oil production that is contiguous with or below the perforated interval for the disposal well. Two of several wells that are a key the issue are going to be the E. P. Operating Company No. 7 Well, and that's shown on many of the displays. The No. 7 Well was originally produced as a Fusselman well and it was subsequently depleted in the Fusselman. It was plugged back and a bridge plug was set and it was produced in the Penn. It is our contention that there is no future remaining opportunity for production of oil either by coming in and reperforating that well or doing anything else with that well in the Fusselman. The operator of that well, E. P., has depleted that reservoir at that point and there remains no further reserves that are at risk with disposal as we propose.

Another well of concern is the E. P. Operating Company No. 8 Well. The No. 8 Well is also

a well operated by E. P. Operating Company. It is our contention that that well after careful review and study of the data is not jeopardized; there is no remaining future production in that well. It's been depleted in the Fusselman and there is no opportunity remaining for future production out of that well.

We'll present to you two witnesses. One is a reservoir engineer, Susan Courtright. She testified before the Division Examiner back in October of this year, which resulted in the Commission's approval of the disposal well in Case 9511. It's Order No. R-8780.

And in addition we will present Mr. Rick Halle, H-A-L-L-E. Mr. Halle is a geologist, a petroleum geologist, and he'll present to you the geologic presentation of his position.

We believe after conclusion of the presentation of all evidence you will re-affirm and confirm the Division action approving the disposal of produced water in the Fusselman, to be re-injected back into the Fusselman, and we can do so to prevent waste and to protect correlative rights in this case.

Thank you.

MR. LEMAY: Thank, you, Mr. Kellahin.

Mr. Carr?

MR. CARR: May it please the Commission, as Mr. Kellahin has noted, this is the ownership of the producing reserves in the South Peterson Fusselman Pool.

Enserch Exploration acquired its interest by farmout from Phillips and that resulted in this basic checkerboard pattern, and then Enserch went forward and they drilled the discovery well in this pool. Other development followed.

From the very beginning water disposal and water problems have been a major consideration in the development of the reserves in this particular reservoir.

Because of that Enserch came before you in 1981 and asked for your approval to dispose of produced waters in the Rader No. 2 Well, which is indicated by the green arrow. This well, as the evidence will show, is down structure from the producing wells off to the west, just like the current proposed disposal well is down structure from the current producing or wells that are capable, we submit, of producing to the west.

Because the Commission on the objection of Phillips denied our approval or our application to dispose in the Rader No. 2. Enserch has, at the expense of over a million dollars, drilled a disposal

well out of the reservoir 10 miles away, laid a line, and has now been able to deal with the water problems that in fact were governing much of the development efforts in this particular reservoir.

Now, you're going to be asked today to look at what we submit to you are very similar fact situations. Phillips is going to disagree. We have two proposals, one in '81, one now, for disposal down structure. We have a reservoir which although obviously they're going to talk about an oil/water contact, is an extremely highly fractured reservoir, and one of the arguments in '81 and I submit one of the things you'll be asked to address today, is that due to the highly fractured nature of the reservoir it's difficult to say when we put water in this well where that water is actually going to wind up.

We also have another difference. When we came before you in 1981 we were suggesting that we dispose down structure in the Montoya and today Phillips is before you asking for approval to dispose of water in the main pay section and they're going to say, yes, it's very different. The reservoir has been produced. It doesn't have the reserves that it did then, but as we go into this, I would ask you to remember that protection of correlative rights and the prevention of waste are not

questions of degree. If we have reserves there and if what they are proposing would tend to reduce the ultimate recovery from the reservoir, as we submit it does and we believe that we can show you that it will, then you will have no choice at the end of this hearing but to deny the application because it will result in oil being left in the ground and the impairment of the correlative rights of other interest owners in the pool.

MR. LEMAY: Thank you, Mr. Carr.

Please proceed, Mr. Kellahin.

MR. KELLAHIN: Thank you.

Mr. Chairman, we have passed out to the audience and to the Commission copies of Ms. Courtright's exhibits that she'll discuss this morning. They are numbered Exhibit -- Phillips Exhibits One through, I believe, 15 is the last one in her package.

SUSAN G. COURTRIGHT,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Ms. Courtright, for the record would you

please state your name and occupation?

A My name is Susan Courtright and I'm a reservoir engineer for Phillips Petroleum Company.

Q Let me ask you to pull the microphone closer to you.

Would you describe for the Commission when and where you obtained your degree in petroleum engineering?

A Yes. I obtained my BS in petroleum engineering in 1986 form Colorado School of Mines.

Q Subsequent to graduation in 1986, Ms. Courtright, would you summarize for us what has been your employment experience as a petroleum engineer?

A For the last two years I've been employed with Phillips Petroleum Company, the last year of which I've been a reservoir engineer.

Q What is the geographic area that you practice as a reservoir engineer with Phillips?

A My main sub-area is the Lovington sub-area, which covers Lea County and Roosevelt County.

Q Have you made a specific engineering study of the South Peterson Field in Roosevelt County, New Mexico?

A Yes, I have.

Q And is that the area generally shown on

what is marked as Phillips Exhibit Number Four, that's the large display?

A Yes, it is.

Q When we look at the South Peterson Fusselman Field, what is the productive formation in that field?

A We are looking at the Fusselman-Montoya formation and also the Penn formation.

Q Have you made an engineering study that included the geology with regards to the South Peterson Field?

A Yes, I have.

Q And what were you specifically asked to do by your company?

A Well, (unclear) the reservoir and that it has declined (unclear) over the last eight years. The majority, the disposal costs constitute the majority of our operating expenses and I was asked to find some way to reduce these costs and the reason why I needed to do this is the high cost of our disposal was going to cause or will cause the premature abandonment of our wells in this pool.

Q Have you completed your study?

A Yes, I have.

MR. KELLAHIN: At this time, Mr. Chairman, we tender Ms. Courtright as an expert petro-

leum engineer.

MR. LEMAY: Her qualifications are acceptable.

Q Give us some general background, Ms. Courtright, of what has been the development history of the South Peterson Field.

A At one time the acreage was Phillips Petroleum's and under a farmout agreement E. P. Operating obtained the window, or the checkerboard here, the 80-acre checkerboard, as shown.

Q What was the original well that was the discovery well for the pool?

A The discovery well was the EPO Well No. 1.

Q That's this well here in Section 31?

A Yes, sir.

Q Okay. Then when we look at Exhibit Number Four, take a moment and describe for us how the wells have been color coded on the display.

A As you can see at the bottom of the exhibit, the orange refers to Fusselman completions and the blue refers to Penn completions.

If a well has been plugged back or was produced in the lower formation and plugged back, you will see a slash through that color.

Q Does the orange arrow representing the Lambirth A No. 6 Well, is that your proposed disposal well?

A Yes, that's the well that I found that's best suited for our disposal well.

Q That represents your personal recommendation.

A Yes, it does.

Q Describe for us, or at least identify for us, what Phillips' producing wells in the Fusselman also generate formation water that you propose to dispose of in the No. 6 Well.

A High producing, water producing wells in the Fusselman are our Phillips No. 2 --

Q Right here on the edge of the circle?

A Right there.

Q All right.

A The Phillips No. 1 located, excuse me, right --

Q Also in Section 31 down here in the southeast quarter?

A Yes, and Phillips No. 3.

Q And the No. 3, then, is in the southwest quarter of Section 31?

A Yes.

Q All right, are there any others?

A Yes. We do have a Lambirth State Lease, which is also a Fusselman producer and produces water and --

Q That's over here in Section 36?

A Yes, it is.

Q Okay. Other than those four producing Fusselman wells that generate produced water, do you anticipate the need to have other produced water in this immediate area disposed of in the disposal well?

A Our Penn producers produce very little water but we would also be using this well to dispose of that water.

Q Currently what does Phillips do with the water it produces from its wells?

A We give our well -- our water to E. P. Operating for disposal at a cost of 40 cents per barrel.

Q Approximately how long have you paid E. P. Operating Company 40 cents a barrel to dispose of your produced water?

A I know that we've been under contract for at least three years and I believe the last year of which we have been paying the 40 cents a barrel.

Q In making your study, would you summarize for us, Ms. Courtright, the available information that you reviewed in order to complete your study for a

disposal well?

A Yes, sir. I reviewed all the records that we had available as our files, our well files. Our well files on E. P. Operating wells and I've also reviewed the last transcripts from the last two hearings in 1981.

Q When you as a reservoir engineer go out in a field such as the South Peterson Fusselman trying to find a disposal well, what factors or criteria are important to you as an engineer in order to select the most suitable disposal well?

A There's basically four factors that are important to me and the first one of which is having a readily obtainable wellbore and I would like that wellbore to be on the basic production lease itself so as to avoid any sort of royalty payments.

Q Other than the readily available wellbore, what are some of the other factors that you mentioned?

A One other is that I would like the injection water to be compatible with the produced water and in this case, with my selection of the No. 6 Well, we will be reinjecting the produced Fusselman water back into the Fusselman formation.

Q Those are two of your factors or criteria. What is the next factor?

A The disposal zone needs to be able to accept large volumes of water at a low pressure and this would just be most economic for us so that we wouldn't have to install any sort of injection (unclear).

Q In addition to finding a well that will accept large volumes of water at low pressures, that consequently will have an economic benefit to Phillips, are there any other reservoir results from finding a well that will take large volumes of water at a low pressure?

A Most importantly I wanted to make sure that it wouldn't cause any waste or impair any correlative rights.

Q And have you found such a well?

A Yes, I have and I recommend the Lambirth A No. 6 as our disposal well.

Q Describe for us generally as reservoir engineer the reservoir mechanics, drive mechanism, and how the well is -- the field is being produced.

A The drive mechanism of this field is a basic strong water drive reservoir.

Q Currently how many producing Fusselman wells are there in the field, approximately?

A There are approximately seven, seven producing Fusselman wells.

Q We have shown on Exhibit Number Four by

a green arrow the E. P. Enserch Rader No. 2 Well in Section 32. You're familiar with that well, are you?

A Yes, I am. This is what Enserch proposed in 1981 and did convert to a disposal well.

Q Why did you as an engineer care about the history of the Commission's action on that particular well?

A Well, I needed to research what had happened in those past testimonies to make sure that I was not indeed choosing a well that would contradict what they found in 1981.

Q Describe for us as a reservoir engineer those facts that existed in 1981 that you felt were important in making your decision about finding an appropriate and suitable disposal well for your water now.

A One thing that contrasts from what the case was in 1981, in 1981 the two offsetting Fusselman wells to the E. P. Rader No. 2 were the Phillips Petroleum Lambirth A-4 and No. 1.

Q Here in Section 31 in the northeast quarter is the No. 4 Well?

A Yes.

Q And down here in the southeast quarter of the same section is the No. 1 Well?

A Yes, and those were our direct diagonal

offsets to the Enserch proposed well.

Q At the time that that well was heard by the Commission back in 1981, what was the approximate producing rates of the No. 4 Well?

A At that time the No. 4 Well was producing in excess of 100 barrels a day.

Q And with regards to the No. 1 Well in the southeast quarter of 31, what was its approximate producing well rate?

A This well was producing about 40 barrels a day at that time.

Q Describe for us what important and material facts represented Enserch's or E. P.'s contention at the time in 1981?

A At that time in 1981 the only Fusselman production that would be put at risk was indeed Phillips Petroleum production, and now, in 1989, today, with our proposed disposal well, the Lambirth A No. 6, the closest Fusselman production is shown some 3800 feet away, which would be the E. P. Operating No. 9, No. 10 and our Phillips Petroleum Well No. 2, and of those three, our No. 2 Well is the best producer, producing about 50 barrels a day.

Q All right, let's identify those wells. When we look at the radius around the disposal well, you've got a 3800-foot radius and as we move counterclockwise,

then, we get to the E. P. Operated No. 9 Well?

A Yes, (not clearly understood).

Q And what does that well currently produce?

A That well produces about 7 barrels of oil a day.

Q All right, and as we move counterclockwise, then, we get down into the No. 10 Well, which is the replacement well near the 6?

A Yes, that's correct.

Q And what is the approximate current daily rate on that well?

A It produces about 15 barrels a day.

Q And then finally as we move into the Phillips Well, the No. 1 Well in Section 32 --

A Yes.

Q -- what does that produce on an average daily basis?

A The No. 2 Well, which produced at about 46 barrels of oil a day.

Q What is the distance, then, to the -- form the disposal well that you proposed for the No. 6 Well, and the closest Fusselman production?

A It's about 3/4 of mile away, which is outside the half mile radius of investigation.

Q Can you contrast that to the distance between the closest producing wells that existed at the time in 1981 when E. P. was seeking to get the No. 2 Well as a disposal well?

A Yes, at that time, in 1981, both the No. 4 and the No. 1 Well were within the half mile radius of investigation.

Q The distance, if we were to scale it off between the No. 2 and the No. 4 Well is approximately how many feet?

A Approximately 1700 feet.

Q Other than the distance to current production, as well as the difference in the volume of that production between '81 and 1989, are there any other material differences that you as a reservoir engineer have found in reviewing that material?

A One thing that I found is that now the water disposal costs are a major factor in our operating expenses and as such, if we have to continue at our high operating or our high disposal costs, that it could cause the premature abandonment of our wells in this pool, and in 1981 we were looking at $35.00 oil as compared to $16.00 oil now.

Q Have you made any economic and engineering calculations to determine or try to quantify the amount

of production, remaining future production in the reservoir, that can be recovered if the costs of disposal are reduced?

A Yes. I made several economic runs and if we can reduce our disposal costs from the current 40 cents down to 10 cents, we could recover an additional 58,500 barrels.

Q You have satisfied yourself that if this well is approved for disposal, then Phillips' direct cost for disposal are reduced to 10 cents a barrel?

A Yes, I have.

Q And the current contract rate with Mr. Carr's client is $40.00 a barrel?

A No, it is --

Q 40 cents a barrel.

A Yes.

Q At the time in 1981 when -- can -- can you make a comparison for us, Ms. Courtright, as to what volume 58,500 barrels of oil means to this reservoir?

A This represents the volume that -- that half these wells have not accumulated 58,000 barrels of oil in this field.

Q Let me have you turn to what you have marked as your Exhibit Number One.

Would you identify that exhibit for us,

Ms. Courtright?

A Yes. Exhibit Number One is the area of review and it shows with the orange area our proposed injection -- disposal well, and around that is the half mile radius for the area of investigation, and surrounding that is the 2-mile radius.

Q Each of these circles is at a different radius than the circle we saw in Exhibit Number Four.

A Yes, that's true.

Q The purpose of the earlier circle was what?

A The purpose of the earlier circle, which was 3800 feet, was to show the distance to the closest Fusselman production right now.

Q Within the 2-mile radius circle area, have you examined the wellbore information available within that area?

A Yes, I have.

Q And have you done so in order to prepare the Commission Form C-108?

A Yes, I have.

Q And did you prepared that form?

A Yes, I prepared that form.

Q Let's again identify some of the key wells in the reservoir.

First of all, in the center of the half mile radius circle is what?

A That is the well which I propose to convert to a disposal well, the Lambirth A No. 6.

Q And again a green arrow points to?

A To the well which Enserch proposed in 1981 to convert to injection -- or disposal.

Q When we look at the Peterson Field and the South Peterson Field, help me identify generally where the break in the reservoirs occur.

A Generally, you can tell that by in Section 19, there are two dry holes there. One is the Petrus Oil No. 1, located in the southeast quarter of Section 19.

Q This one here.

A Yes.

Q Okay.

A And also, immediately to the west of that, is the Amoco Kellian Well.

Q It's your opinion, then, that everything south of a line drawn between those wells represents production in the South Peterson Fusselman?

A That's a real good break line there.

Q And as we move north, then, what are we into?

A We are (unclear) the Peterson Pool.

Q What is the importance to you as an engineer of the pink arrow up in Section 18?

A The pink arrow identified Petrus Oil's Swearingen C disposal well and they are currently disposing into the Fusselman-Montoya.

Q Why is that important to you as an engineer in evaluating this area?

A It shows me that the Fusselman does in fact take water and will act as a disposal formation.

Q Let's turn to Exhibit Number Two, if you will.

Before we have you describe the points and conclusions you made from this display, simply take a minute and help us understand how to read the information.

A Exhibit Number Two shows the monthly average production from our Fusselman and Penn completions in this area and once again anything dealing with blue is a Penn completion; anything with orange is a Fusselman completion.

Q What information is shown on the boxes adjacent to the various wells?

A It shows the monthly average production, the oil production, gas, water, and also the water cut.

Q When we look at the proposed disposal well, the well in the center of Exhibit Number Four and the

one shown the green arrow on Exhibit Number Two, what -- what is the importance of the information shown in the blue box?

A Well, it certainly shows that this completion in the Penn is uneconomical and it will be abandoned.

Q So in converting the currently producing Penn well at this location to a disposal well in the Fusselman, do you have an engineering opinion as to whether or not you are prematurely abandoning commercial oil production out of the Penn?

A Oh, no, we're not. This has -- this well has declined and we do not feel that there's any economically recoverable reserves remaining in the Penn.

Q Let me have you look at the production information that's shown on your Exhibit Number Four and describe for us what that means to you as an engineer when we look at the E. P. No. 8 Well to the west.

A The E. P. 8 Well shows the current completion in the Penn. It is no longer producing from the Fusselman.

It shows that this well is also uneconomic producing right now from the Penn formation.

Q What has been the history of production on that well, the No. 8 Well?

A They completed this well in the Fusselman. They abandoned this well sometime later producing in excess of 10 water/oil ratio, and they squeezed these formations, set a bridge plug and they moved up hole to the Penn formation.

Q Do you have an engineering opinion as to whether or not there continues to be present in the Fusselman formation for production out of that No. 8 Well commercial oil production from the Fusselman?

A Yes, sir. There -- there wouldn't be any remaining commercial production from the Fusselman in that No. 8 Well.

Q As we move over to the south and east of the disposal well and look at the E. P. Operating Company No. 7 Well, what does your information on Exhibit Number Two show about that well?

A This well -- this shows that it was also at one time completed in the Fusselman. They abandoned that, that zone. I concur with their abandonment in this well, and they moved up hole into the Penn formation.

Q In making your engineering evaluation of the information available for the No. 7 Well, what is your conclusion about the future remaining potential for production of commercial oil from the Fusselman formation in that well?

A I believe that there isn't any, or I know that there isn't any remaining commercial production from the No. 7 Well in the Fusselman.

Q As we continue to look, then, at the area of review within the half mile radius --

A Yes.

Q -- we've looked at the No. 7 Well, the proposed disposal well No. 6, the No. 8 Well, do you find any other wellbores within the half mile radius?

A No, you do not.

Q Let's go to the edge now and just outside of that half mile radius and have you identify for us the closest commercial Fusselman production.

A Okay. The closest Fusselman production, as shown on the radius of this circle on Exhibit Number Four, would be the Enserch No. 9, which is producing 6.5 barrels per day; the No. 10, which is producing 14.6 barrels of oil per day; and also our No. 2 Well, which is producing 46.3 barrels of oil per day.

Q What is the approximate daily volume in barrels of water that you propose of disposing in the disposal well?

A An average volume would 900 barrels of water per day with the probably maximum being 2000 barrels of water a day.

Q If the Commission approves your disposal well for disposal of that volume, do you see any risk or jeopardy posed to any of those producing wells that will cause them to have their Fusselman oil production prematurely encroached upon by the water injected or disposed in the No. 6 Well?

A No, sir.

Q Why not?

A These wells, it would take -- they are already currently producing at such a high water cut, if you would look at the No. 10, it's a 96 percent water cut and our NO. 2 is an 84 percent water cut. We've done some water encroachment calculations and it shows that it would be a substantial amount of time until water would even reach these wells, and that is only a one percent increase in water cut.

Q The bottom number in each of the boxes represents the percentage of water cut?

A Yes, it does.

Q And 96 percent represents the water portion of the percentage?

A Yes.

Q Is there a rule of thumb or some percentage you can tell us that represents the point at which you consider your water cut is too high and you're going to

abandon your well?

A I would certainly say that around 10 water/oil ratio and which is shown on the next -- next exhibit, Exhibit Number Three.

Q Before we leave Number Two, you said you have made some encroachment calculations based upon a volume of water injected into the Phillips lease for the No. 6 Well.

A Yes.

Q Can you quantify that in a period of time? How long would it take you disposing of water at 900 barrels of water a day for that water to leave the lease?

A It's a belief if we assumed a direct circle and that everything would fill up 100 percent, it would take probably about eight years until we crossed our lease line.

Q Let's turn now to Exhibit Number Three, Ms. Courtright.

Again before we talk about your conclusions to be drawn from the display, simply take a moment and help us identify how to read the display.

A This is the cumulative production through the end of November of 1988. It shows the cumulative barrels of oil, MCF of gas, barrels of water, and it also gives the final water/oil ratio. This is done for

each of the completions whether in the Penn or in the Fusselman.

Q When we look at a given box of data, let's take the one that's just north of the disposal well --

A Yes.

Q -- the little blue box? Read down the information and tell us what each of those means to you.

A That shows that the No. 6 Well in the current Penn completion has produced almost 1200 barrels of oil. It's produced 38,000 MCF, 236 barrels of water, and its total water/oil ratio is approximately .2.

Q What is the importance of this type of analysis for you as a reservoir engineer in trying to find the most suitable disposal well for the produced Fusselman water?

A I would know that -- well, first of all, I've taken a look at Enserch' discovery well, which is the No. 1 Well located in Section 31, and this well being on the top of the structure has cumed about a million barrels of oil and has cumed 873,000, and the water/oil ratio on this is .1.

And as we move further north in the --

Q Well, excuse me, what does that tell you, then, about the discovery well?

A This well has not -- it's not in communication with the water drive reservoir and basically it (not clearly understood) on the top of the structure.

Q Is that any surprise to you as a reservoir engineer when you integrate the structural position of this well in the reservoir?

A No, certainly not.

Q That's an anticipated result of production from being at this point in the reservoir.

A Yes.

Q And this well is at a higher point in the structure?

A Yes, it is, and as you move further north and further down structure, even our best well, which is the No. 2 Well located immediately north of there, of discovery Well No. 1, it's only cumed about 300,000 barrels of oil and this a third less than what their well has cumed to date, but as you can see, we're moving further down structure and we are approaching this water/oil ratio. In our No. 2 Well it's a 3 water/oil ratio.

Q Is there a particular number or percentage when you're dealing with the water/oil ratio that tells you something as an engineer?

A Well, certainly the higher the water/oil ratio, the more water that you are producing, and the

closer it is to the edge of the structure.

And also I wanted to point out that if you move even further north to the EPO Operating No. 8 Well, which was completed in the Fusselman, you are real close structurally to our No. 6 Well and you can see that it hasn't cumed very much. It was 42,000 barrels of oil but this was closer than the (not clearly understood.)

Q In analyzing this data does it tell you anything about the stage of depletion in relation to the water/oil ratio?

A Well, certainly that the wells further down structure are more depleted.

Q Where, then, have you chosen to to place your disposal well in the structure in terms of the impact of that disposal on other production in the field?

A Our No. 6 Well is the furthest well down structure.

Q Do you see any other disposal or any other wells in the field that offer the opportunity for disposal that meets your criteria or factors that the No. 6 Well doesn't?

A No, sir, we've examined some other wells, particularly our No. 4 Well and our No. 5 Well, which are currently shut in. We've examined these wells but we feel like the No. 6 Well is the best candidate for

our disposal well.

Q When you talk about the No. 4 Well, you're looking at the one in the northeast of 31?

A Yes.

Q And then the No. 5 Well is the Penn well down in the southwest of 30?

A Yes.

Q All right, and now we're back to Exhibit Number Four and we've discussed that one.

Let's move on to Exhibit Number Five. To make sure we're all with you, what is Exhibit Number Five?

A Exhibit Number Five is the decline curve for the Fusselman completion E. P. Operating Well No. 7.

Q When we look at the legend on the bottom of the display it says, "E. P. Operating"?

A Yes, it does.

Q And then when we go over, it says, "Well" and we look to the digits and find the 7?

A Yes, and the completion is found with the red underline in the bottom righthand corner.

Q That's a -- that's a Dwights identification number for the well?

A Yes, it is.

Q And if you look at the last digits then

that will tell you it's Fusselman?

A Yes.

Q If it was Penn, what would those digits be?

A It would be PN.

Q What -- what is on the horizontal scale of the display?

A The horizontal scale is time in years.

Q And what's the vertical scale?

A It is a logarithmic plot of the oil production in barrels per day.

Q What was the source of the information that's used to plot on the display?

A This comes from Dwights production or Dwights data base, which I believe gathers its information from the State completion records.

Q What was -- what were you trying to understand or investigate in terms of finding a disposal well that caused you to make this display?

A I wanted to see exactly what their No. 7 Well was doing at the time that they abandoned this well.

Q Can you go back in time on the display and show us what is the likely or more realistic producing rates out of the well without a shut-in period?

A Yes. If this well continued to produce,

you can see in the latter part of 1984 that it was producing less than one barrel of oil per day and water per day.

Q Let's go back and find the point in time in the summer of 1981 that Enserch was seeking to use the Rader No. 2 as a disposal well. What was the producing rates on the No. 7 Well, approximately, at that time?

A In 1981, mid-1981, this well was producing close to 50 barrels of oil per day and the same amount of water per day.

Q All right, let's turn now to Exhibit Number Six. Would you identify that one for us?

A Yes. Exhibit Number Six is the current production for E. P. Operating's No. 7 Well, but this time it's in the Penn formation.

Q Okay, so No. 5 is the Fusselman and your conclusion, then, about the Fusselman portion of production in the No. 7 Well was what?

A I concur with their -- their workover to abandon this formation.

Q Now we're looking at the Penn portion of that production in the same well?

A Yes, we are.

Q Okay, what did you find when you examined that production?

A That certainly it is uneconomic at this time.

Q When you made that study, have you put the results of that study on the display to show us the economic analysis?

A Yes, they're summarized in the upper righthand corner.

Q Without reading through all the numbers tell us what it says.

A Basically that they are losing money off this well.

Q All right, let's turn to Exhibit Number 7. Would you identify that display for us?

A Yes. Exhibit Number Seven is the decline curve for their No. 8 Well, their Fusselman completion in E. P. Operating's No. 8 Well.

Q Okay, again show us at what point in tabulating the production you find points that are important to you as an engineer.

A Well, at the time of abandonment their production rate was 3 barrels of oil per day and 5 barrels of water, but this was after 8 months shut-in period. Previous to that they had two 7-month shut-in periods.

If you look at the production as they just -- after continual production, at the end of 1984 they

were producing about 4 barrels of oil a day and in excess of 100 barrels of water a day.

Q Do you see any opportunity to restore commercial oil production in the Fusselman in this well?

A No, I don't. This well was abandoned at a high water/oil ratio and it has been watered out.

Q Let's turn to Exhibit Number 8.

A Yes. Exhibit Number 8 is the decline curve of their production for their No. 8 Well in the Penn formation.

Once again, as with their No. 7 Well, I've shown in the upper righthand corner that this well is losing money.

Q Can you approximate for us at what point the Lambirth No. 8 Well became uneconomic?

A We approximate that economic limit on the Penn well is 3 barrels of oil per day.

Q Using approximately what water/oil ratio are you to make that -- that conclusion?

A Basically we are using our -- not based off of the water/oil ratio, but based on the lifting costs that we have from our own Lambirth B Lease, which is the single well lease in the -- in the proration unit.

Q All right, let's turn now to Exhibit Number Nine. Before we discuss your conclusions please de-

scribe how to read the display.

A This exhibit shows the combined production, the Phillips Petroleum combined Fusselman production. What is shown in the solid line is actual data. What is shown forecasted, or with the dots, is the forecasted data.

The horizontal axis is time in years and the green axis to the left is oil production rate in thousands of barrels per year.

On the righthand axis, the brown axis, is the cumulative production in thousands of barrels of oil.

Q By analyzing this display what do you conclude?

A Certainly that our reservoir is well on its way on decline, it is declining, and if you compared this with 1981, when the last hearing was taking place, you could see that this reservoir was at peak production.

Q The production is shown in the green hatched lines?

A Yes, it is.

Q And in 1981 that represents the highest producing rate for the Phillips wells in the reservoir?

A Yes.

Q The number 58,500 barrels of oil that's typed in --

A Yes.

Q -- on the red dashed line, what does that tell you?

A This is what my economic runs indicated, that if I reduce our disposal cost from 40 cents a barrel to 10 cents a barrel, we can extend our producing life from the Fusselman production an additional four years and gain an additional 58,500 barrels of oil.

Q All right, let's turn to Exhibit Number Ten. I'm sorry, Exhibit Number Nine is stapled together with a second page.

A Yes, it is.

Q Well, let's look past the first page of Nine and look at the second page.

A The second page of Exhibit Nine basically shows the very same thing that is shown on the first page. It shows just exactly how -- what additional recovery we can expect to get with our reducing disposal costs.

Q All right, now let's go to Exhibit Ten.

I've put up a larger copy of Exhibit Number Ten, Ms. Courtright and first of all would you identify what you have prepared for Exhibit Number Ten?

A Yes. Exhibit -- Exhibit Number Ten shows both the current well schematic of our proposed well,

our Lambirth A No. 6, and it also shows what work we propose to do, which is highlighted in all the red.

Q In terms of wellbore integrity and economic savings to Phillips, is it important to you as an engineer to find a well that has been completed for either Fusselman or Penn production to then convert for disposal purposes?

A Yes. This would be the most economic, to already have a well which was meant to be a (unclear) producer.

Q There are other wells in the area that are dry holes and abandoned --

A Yes.

Q -- either with or without casing and tubing?

A Yes.

Q So the No. 6 Well fulfills that wellbore integrity criteria?

A Yes, it does, or it certainly will after which time we convert this well for disposal. We will need to, as shown on the lefthand side, we will need to perforate at 5050 and circulate cement to surface.

Q Describe for us on Exhibit Number Ten what other work would be required on the well to convert it for disposal purposes.

A We will squeeze the current Penn perforations, which are shown as Item No. 2. They are the perforations 7607 to 7613.

Q In compliance with Division requirements will you fill the annular space between the tubing and the casing with some inert fluid?

A Yes, yes, we will.

Q And will there be a pressure gauge at the surface to monitor any pressure on the casing?

A We'll be monitoring the annular pressure.

Q Describe for us now the specific perforations that you propose to make and then to utilize for disposal. What is the included?

A The proposed injection interval is shown, which is highlighted on our large exhibit with the orange arrow. They will be from 7892 to 7944.

Q When we compare those perforations to the structural position of the Fusselman in this wellbore, where are we in the formation?

A We're in the Lower Fusselman.

Q Was the Lower Fusselman ever tested in the well prior to attempting to convert this for disposal purposes?

A Yes, at the time of initial completion

we did test the Fusselman-Montoya.

Q And what did you find?

A If you'll look under Item No. -- Sequence Item No. 6, shown on the righthand side, you will see that those perforations which were tested in the Fusselman Montoya, after they were acidized, swabbed dry, and there were no oil or gas shows.

Q Approximately what period of time were those swab tests taken on those perforations? When was that?

A This was at the time of completion.

Q When was -- which was when?

A In 1982.

Q Were there any other perforations tested below those that you've just described in Sequence No. 6?

A Yes, we even tested the -- this well was drilled through the top of the Granite Wash and we did test the Granite Wash, which is evidenced by Sequence Item No. 4. These perforations from 8042 to 8056 were also acidized but they were swabbed dry with no oil or gas shows.

Q Subsequent to having the Division approve the conversion of the No. 6 Well for disposal purposes by the order entered on November 7th, 1988, did you and Phillips take any further action on this well?

A Yes, we did. We perforated our proposed

injection interval and we conducted a step rate test.

Q Where are the perforations that you added to the well after obtaining the Division order?

A They're indicated by the orange arrow, which -- they're from 7892 to 7944. These are in the Fusselman Montoya formation.

Q Let's turn now to Exhibit Number Eleven and first of all identify what Exhibit Number Eleven is.

A Exhibit Number Eleven is what Phillips puts out to keep record of any workover or completion work done. This is our daily drilling report. And where we pick up with Exhibit Number Eleven, if you'll note at the top the plugged back TD is 7963, which means that we have already drilled out to the bottom bridge plug shown.

Q I'm looking at the top entry of the exhibit.

A Yes.

Q And the first detail we're looking at then is the swab -- the various swab tests that were conducted on these perforations.

A Yes. The very first you can see where we perforated the well and then we swabbed this. We swabbed for 2-1/2 hours and recovered 24 barrels of water with no trace of oil.

Q All right, then what happened?

A The next day we acidized our proposed injection zone. We rigged up to swab on that and we recovered 80 barrels of water. The fluid level was at 2400.

Q What does that tell you as an engineer?

A That the well was -- was producing water but also some of the swab test was the load water of the (unclear).

Q At what point in the tests are you satisfied that the individuals conducting the physical tests at the wellbore have recovered the load water?

A The load water was recovered on the next day, on December 2nd. They swabbed 160 barrels of water and 120 of which was formation water.

And then on the next day they swabbed for 9 hours and recovered 150 barrels of water. There is certainly no chance that there is any load water being recovered at this time. It is formation water.

Q What does it tell you about the chances of recovering oil?

A They certainly didn't recover any trace of oil. It was all water.

Q Having conducted the test up to that point, did that fully satisfy you about the absence of hydrocarbons in this wellbore at these perforations?

A Yes, it did.

Q Were other activities undertaken on the well? Was it acidized or stimulated or otherwise treated?

A No, it was only acidized.

Q Let's see the entries about the acid treatments.

That was up earlier when we were recovering the load water, wasn't it?

A Yes, it was. That was the second entry on December 1st.

Q Okay. Is this a conventional, standard, widely accepted means by which the operator physically goes down, perforates the zone, and attempts to extract oil?

A Yes, it is, and certainly we don't know for sure what you will be getting until you actually do go down there and swab on the wells.

Q What does this test confirm for you as a reservoir engineer about the suitability of this well for disposal purposes?

A That we will not be injecting into a zone that has any recoverable hydrocarbon reserves.

Q Have you examined the relationship of the new perforations in the disposal well, the No. 6 Well, to the offsetting correlative interval, if you will, in the formation for both the 7 and 8 Enserch Wells?

A Yes, I have.

Q Can you as an engineer draw any correlations between those wells and the absence of oil in comparable formations --

A Yes.

Q -- or perforations in your wells?

A When I correlated the perforation interval of our No. 6 Well to both the offsetting Wells No. 7 and No. 8, they should certainly also, if they perforated in the very same spots, then they would recover water, also.

Q Let's go now to the next activity on the well and I believe that was a step rate test?

A Yes, we conducted a step rate test.

Q Why would you do this?

A We wanted to assure ourselves that we could dispose of water into this interval, large volumes of water into this interval, at a low pressure.

Q And what did you find?

A That we certainly could. If you'll flip to Exhibit Twelve you will see the actual results of our step rate test and I'll explain the different curves to you.

Our green curve are actual data points that we obtained from our step rate test. If you take out friction and obtain the bottom hole pressures, you'd get

the red curve, and it was an interesting note that this red curve overlies what Enserch showed in its testimony in the 1981 hearing, and this is shown on the blue curve.

Q What do the results of the step rate test confirm for you as a reservoir engineer?

A It shows that we can inject well over 2000 barrels of water per day before we encounter any sort of pressure and we would certainly -- we wouldn't -- since it is at such a large volume and such low pressure, we wouldn't need any sort of an injection system and this would be most economical for us.

Q Do you see any information as a result of the step rate test to cause you to believe that the disposal fluids are going to go anywhere other than the Lower Fusselman formation?

A No, sir, we're certainly injecting at a low pressure and with low pressures you would expect all the water to be confined.

Q It would be confined, then, within the vertical limits of the pool?

A Yes, it would.

Q Do you see any potential risk to fresh water sources in the area?

A No, sir, I don't.

Q Do you see in examining the wellbore

integrity of any of the wells in the area of review that they might serve as a source by source by which disposal fluids might migrate into shallower sands?

A No, sir. All wellbores have been examined and all plugged wells have been examined in the area of review, and I didn't find any means by which any fresh water would be in the area.

Q Are you satisfied that you can comply with the Division policy and guidelines of keeping surface pressures to .2 psi per foot of depth in this wellbore?

A Yes, certainly. The maximum injection pressure that we could have is around 1500 pounds and as you see, noting on the lefthand side of our step rate test, 1500 pounds would take us well in excess of over 4000 barrels per day of water.

Q Under the current arrangement for disposal of the produced water by paying E. P. Operating to dispose of that water for you, approximately how much money a month does your company pay Enserch?

A Paying about 40 -- or paying at 40 cents a barrel, we dispose or we pay them about $11,000 a month to dispose of our water.

Q In quantifying the -- the amount of additional reserves that you can recover by lowering your costs of operations in the disposal area, can you give an

estimate of the additional life in terms of months or years for the recovery on your wells?

A Yes, we can extend the producing life or our Fusselman wells by an additional four years.

Q Let me turn to what is marked as Exhibit Number Thirteen and I believe it's all stapled together and represents the Commission Form C-108 and all the attachments?

A Yes.

Q Let's quickly go through the exhibit and make sure we have it complete.

The first page is simply the form. What happens at the second page?

A The second page shows a tabulation of all the wells in the area of review and I've gone over just examining the two wells in the area of review (not clearly understood) the Enserch No. 7 and No. 8 Wells, but I've gone outside that half mile radius of investigation and have examined an additional six wells.

Q And that's represented on the tabulation?

A Yes, it is.

Q Okay. After the tabulation, what do we find?

A Then we find the wellbore schematics of

all plugged wells.

Q Again, in examining the wellbore schematics of each of the plugged and abandoned wells that penetrated the Fusselman formation, did you find any of those that were plugged so inadequately that they'll serve as a source by which the disposal fluids will migrate out of the formation?

A No, they were all properly plugged.

Q We then get to a tabulation of your operations and geology?

A Yes.

Q And then after that you have some water analyses?

A Yes, we do.

Q In making an examination of the currently producing fresh water sources, what is the deepest likely occurrence of fresh water in the area?

A It would be 300 feet to fresh water.

Q Have you examined the surface casing strings in all the wells in the area to see if the cementing and surface casing strings are fixed below the known deepest extent of the fresh water?

A Yes. They're all properly cemented.

Q And you're proposing to re-introduce back into the formation produced water from that formation?

A Yes, it will be produced Fusselman-Montoya water.

Q What else do we have in the package of information for Exhibit Number Thirteen?

A The only other things we have are fresh water analyses and where we gathered those, and for our first hearing in October I was only able to gather two fresh water samples and I wasn't satisfied with that, so if you would flip to a map with yellow arrows and it shows the location of where I gathered six fresh water samples.

Q And finally in the package of exhibits is a log.

A Yes, sir.

Q Would you identify the log for us?

A This is a computer log of our Lambirth -- proposed well, Lambirth A No. 6.

Q Have you marked the various perforations on the log?

A Yes, I have. If you would look down particularly towards the end of the log, you would see at 7600 colored in blue is the current Penn completion.

Further down at 7800 you will see where we perforated and tested the Fusselman formation.

Shown on green is our proposed injection interval and further below that in red is where we tested

the Granite formation.

Q Were Exhibits One through Fourteen prepared by you or compiled under your direction and supervision, or represents information that you have reviewed and satisfied to the best of your knowledge, information and belief, is true and correct?

A Yes, I prepared these exhibits.

Q In summary, then, Ms. Courtright, would you describe for us whether your ultimate conclusions with regards to the ability of you to utilize the Lambirth A No. 6 Well for disposal purposes and to do so without violating correlative rights or causing waste?

A Certainly our Lambirth A No. 6 Well is down structure. It's a (unclear) Penn well which is uneconomical and will be abandoned. We needed to find a well where we could properly dispose of our water. This well is completed through the Fusselman and is most economic for us to convert to a disposal well, and at this point in the reservoir, reservoir's life, knowing that our disposal costs are such a major portion of our operating expenses, if we were able to obtain a wellbore, which we feel our Lambirth A No. 6 Well would be the best one, then we could do away with our high disposal costs and thereby avoid any sort of premature abandonment of our reserves.

MR. KELLAHIN: Mr. Chairman,

that concludes my direct examination of Ms. Courtright.

We move the introduction of her Exhibits One through Fourteen.

MR. LEMAY: Without objection Exhibits One through Fourteen will be admitted into the record.

Let's take about a fifteen minute break.

(Thereupon a recess was taken.)

MR. LEMAY: The hearing will come to order.

Mr. Carr.

CROSS EXAMINATION

BY MR. CARR:

Q Will you tell us when you first started to work on this problem, when you were first asked to find a disposal well?

A It would have been around the summer of 1987.

Q And it was the first time scheduled for hearing in October of 1988?

A I'm sorry, sir, I would have first exa-

mined it in the summer of '88, and yes, it was first scheduled in October of '88.

Q Now you indicated there were other choices that you considered, is that correct?

A Yes, that's correct.

Q And were there other wells in this pool that you considered as possible disposal locations?

A Yes.

Q This one was selected because of its proximity to the offsetting wells from which the water was being produced, is that correct?

A No, sir, it was based primarily on the availability of the wellbore and also that it was furthest down structure.

Q Were there other wellbores that were available that were comparable to this one?

A Yes, sir.

Q Now when we talk about producing water in this wellbore, one of the real objectives of Phillips all along has been reducing its disposal cost, isn't that correct?

A Uh-huh.

Q And this well is located on the Lambirth Lease, is that right?

A The Lambirth A Lease.

Q Is a substantial portion of the water that you propose to dispose of in this well produced from the Lambirth Lease?

A Yes, it is.

Q Is one factor that you'll be able to dispose of this water without having to pay royalty for the injection of the water on this property?

A Yes, it is.

Q And the current disposal system that is operated by Enserch and into which Phillips is now disposing, do you know whether or not you are paying any royalty for that disposal?

A No, sir, I only know that we are paying 40 cents a barrel.

Q And you don't know how that breaks down?

A No, sir.

Q When you were asked to find a well that would be suitable for disposal, were you involved in any other kind of decision as to how you might reduce your disposal cost or were you just assigned the task of selecting the wellbore?

A I was assigned to select a wellbore which would aid me in reducing our cost so we would have our own disposal well.

Q Have you been involved in any decision

or any discussion concerning approaching Enserch about adjusting the cost for the use of their disposal system into which you're now disposing water?

A No, sir, I have not been directly involved in that.

Q Have you been indirectly involved?

A Yes.

Q And are you aware of any conversations with Enserch concerning a reduction in cost?

A No. I know that they have taken place but I don't know what they were.

Q And you're not aware of any prior, prior to the time you were looking for a wellbore (unclear).

A No, sir.

Q Now you indicated that you had studied the area and that study included reviewing your records and also the prior hearing, isn't that correct?

A That's right.

Q And in making that study you also attempted to pick a location that was consistent with prior Oil Commission orders on this area.

A Yes, that's correct.

Q And you've reviewed the order that resulted from the 1981 hearing, have you not?

A Yes, I have.

Q And that order discusses the existence and evidence of vertical fracturing in the reservoir, doesn't it?

A Yes, sir.

Q And it also finds that the extent of this fracturing is unknown, doesn't it?

A Yes, sir.

Q Did you consider the fracturing of the reservoir in making your determination?

A Sir, I believe that what you stated, that the extent of the fracturing is unknown, it is known that this does stay within the Fusselman-Montoya.

Q But it can move through the Fusselman-Montoya, can it not, in these fractures?

A Yes.

Q And the very nature of a fracture is a conduit through which fluid can move, isn't that right?

A That's correct.

Q And the -- are you aware of any work on the orientation or extent of the fracturing within the Montoya and the Fusselman?

A No, sir.

Q In making your study of the area you also, I would assume, reviewed the testimony presented by Phillips in the 1981 hearing, is that correct?

A Yes, in both the original hearing and the de novo hearing.

Q And you reviewed the testimony of Phillips' engineering witness, Mr. Blevens?

A Yes.

Q Mr. Blevens at that time, if you would recall, stated that because of the fracturing that it was impossible to tell where the water disposed in this formation would actually go? Do you recall that?

A Yes.

Q And do you agree with that?

A I -- what he was stating is that there was no way to monitor where the water would go from your proposed No. 2 Well until it had actually reached our No. 4 Well. I believe that's what he's referring to.

Q And didn't he also state that because that because of the fracturing you couldn't tell where the water was going and that it could water out some wells, some of your wells very rapidly?

A Yes.

Q Do you agree with that testimony?

A At that point in time, since we did have our high producing wells, in excess of 100 barrels per day, yes, that was very likely, since there was no containment within only the Montoya formation.

Q And so because -- I'm trying to understand your last answer. Your answer was that because you had these high producing wells and there was no containment in the in the formation because of fracturing, that you could, in fact, experience very rapid watering out. Is that, is that what you said?

Please state it again. I'm not trying to put words in your mouth.

A That was our contention at our 1981 case, that, yes, indeed, we could experience waste, waste of our economic (unclear) reserves.

Q And are you concerned that the fluids would be drawn to areas where there were lower pressures in the reservoir? Is that a concern?

A No, sir.

Q You don't believe that if there is a pressure drawdown in a portion of the reservoir, say, due to offsetting production, that the fluids would migrate in that direction through the formations?

A All these wells have been producing and of course there are pressure drawdowns. It certainly could.

Q And if there's a pressure drawdown it is not unreasonable to expect that the fluids could move through the fractures in that direction, is it?

A Yes.

Q And if that occurs in fractures where you inject water, it might move toward properties on which wells are or have produced, isn't that right?

A Yes.

Q When you talk about injecting water and it staying in sort of a radial pattern and not getting onto your lease for a year, is that -- if in fact there are not fractures and pressure variations that might cause (not clearly understood).

A Yes, that's assuming a homogeneous cylinder.

Q All right, and based on your study of this reservoir you do not have something that's comparable to a homogeneous cylinder at this time, do you?

A That is correct.

Q Suppose you have a producing well, '81 or now, the Rader, I think, No. 4 was the offset -- or the Lambirth No. 4 was the offsetting well to your -- to our proposed Rader No. 2, and if in fact you had a lot of breakthrough in that well, that would virtually kill the well, would it not?

A Yes, sir, I believe that it was shown in your 1981 testimony that what happened with your No. 6 Well was there was a water breakthrough and you were not able to

successfully squeeze that and in fact had to drill a replacement well.

Q And in fact once that happens, there's no way to monitor that and know that's going to happen. It just -- you discover it once it occurs, isn't that right?

A That's correct.

Q Now looking at the producing capability of some of the wells in this area, if in fact this watering out or this breakthrough occurred, in your opinion would it be economic now to go back and drill replacement wells for any of these producing wells if you did water out the hole?

A No, sir.

Q In 1981 Phillips suggested to use the Peterson A No. 1 as a disposal well. You experienced -- in the Wolfcamp.

A Yes.

Q You experienced problems with your lessors, did you not, in that case? In fact, Mr. Peterson didn't want Mr. Lambirth's water at all, isn't that right?

A That's correct.

Q And the Lambirth leases are in fact the highest water producing in the area. Do you think that's a fair statement?

A Certainly, I don't -- I can't testify for all the area, but, yes, our Lambirth A Lease does pro-

duce a lot of water.

Q Now when you project the economic life on any of these wells, if I understood your testimony, you were really looking at a water/oil ratio in making a determination as to whether or not the well was economic, isn't that correct?

A Yes.

Q If you're able to reduce your water disposal costs, then a well that might not be economic using this approach could be a more attractive prospect. That's fair, isn't it?

A Yes.

Q And if something could be done to reduce water in some of the wells that are below an economic limit, it's possible that you could return them to the economically viable category, isn't that fair?

A You could do something to get rid of the water, yes.

Q Also when you look at whether or not a well is economic, you are looking at the operating expenses, isn't that correct, and if those are projected at a higher figure than what is the actual cost, that also might cast a well as noneconomic that might otherwise be a viable project.

A By projecting your operating expenses,

what do you mean, Mr. Carr?

Q Well, if you're stating a $1500 a month operating expense and it's actually $700, that would tend to advance the economic limit on that well, would it not?

On Exhibit Number One you indicated the Petrus No. 1 Well was a disposal well. Into what formation is the water being disposed in that well?

A The Fusselman-Montoya.

Q Are you sure that's a Fusselman and not a Pennsylvanian?

A Yes.

Q You had some opinions as to the economic viability of the Enserch Lambirth No. 8 Well and you talked about the oil/water ratio. Can you tell me what oil rates were being produced at the time that well was abandoned?

A Yes, sir. If you and the Commission will please refer back to my Exhibit Number Seven, and you will see that at a constant rate of production up to the -- prior to this well being shut in for extended periods of time, this well was producing around 4 barrels of oil per day and in excess of 100 barrels of water per day.

Q And when did -- when you say before the shut-in, what date are you using?

A I am using late 1984.

Q Did it produce after that time?

A It produced for -- after a 7-month shut-in period it produced for approximately 3 months. It was shut in for 7 months again, and produced for 4 months.

Q And after, when it was produced after those shut-in periods, how did its production rate compare to the prior producing rate on the well?

A The oil increased approximately 2 to 3 barrels a day but the water increased by 100 barrels per day.

Q And are you aware of what the cause of that water was, what the source of it was, other than just formation? Are you aware of any casing or mechanical problems with that well?

A No, sir, I have looked through the papers that Enserch has reported with the State and, no, there has not been reported any casing problems.

Q Now when you talk about this well having watered out, are you simply basing it on the production information you have or do you have some separate information that would show in fact there's been a breakthrough in that area of the water?

A I am basing it on the production information.

MR. CARR: I have no further questions of this witness.

MR. LEMAY: Thank you, Mr. Carr.

Additional questions of the witness?

MR. BROSTUEN: I've got a question or two here.

MR. LEMAY: Mr. Brostuen.

QUESTIONS BY MR. BROSTUEN:

Q I believe you stated that this is a water drive reservoir.

A Yes, sir.

Q I believe you made the statement, I'm not sure if I heard correctly, that the E. P. Operating Well No. 1 is not in communication with the water drive reservoir. Did you make that statement?

A Yes, I did, but I would like to correct what I said.

This well is feeling the support of the water drive reservoir but it has not experienced the break-through that, as you see, a lot of the bottom structure wells have.

Q So you're simply saying that -- stating that breakthrough has not occurred, that water production -- the water production of the well had not been affected

by the -- by the waterflood -- pardon me, the active water drive.

A It is providing pressure support.

Q Yes. Would you consider this a strong water drive, a weak water drive?

A I would consider it a very strong water drive. The pressure has not decreased 10 pounds over -- since that time of initial discovery.

Q I believe you stated that the oil/water contact could not be readily determined. Is that because insufficient wells have been drilled, say, or are present to indicate where that water drive is now? By watering out you could not determine where the oil/water contact is at the present time?

A I don't believe that I've stated anything about the oil/water contact, but I know that further work with our geologist has been done as to determine the oil/water contact.

Q That's all I have. Thank you very much.

QUESTIONS BY MR. LEMAY:

Q I have a couple of questions. Ms. Courtright, you mentioned, following up on Commissioner Brostuen's comment on an active water drive, is it typical in a water drive field to have both the oil and the water

rates decline with time or is it normally that the water -- that the fluid volumes remain constant, the water increases and the oil decreases?

A I would expect that the water production would increase.

Q Your Exhibits Five and Seven seem to show that except for that shut-in period on Exhibit Five, the No. 7 Well indicates a total decrease of fluid production through time. Is that typical of a water drive reservoir?

A Well, sir, I would like to refer you to Exhibit Number Three.

Okay, Exhibit Number Three, if you will look at their Well No. 7 and what their cum water/oil ratio was .5. This well has not received the benefit of the water drive reservoir and if you compare this to our No. 4 Well, immediately south of their No. 7, you will see that we have a very comparable .5 water/oil ratio, and this -- both of these wells have pressure depleted. We obtained a bottom hole pressure on our No. 4 Well which has been shut in for over a year, and it didn't -- it wasn't even 100 pounds.

The No. 7 Well and the No. 4 Well pressure depleted.

Q So is it your testimony, then, that

these wells are not in contact with the main reservoir because of pressure depletion?

A They are not feeling the effect of the water drive reservoir.

Q So if they're not in pressure communication with the rest of field, is that a separate field encompassing Wells 7 and 4?

A No, sir, I feel this is due to the fractured nature of our reservoir, that some wells do feel the benefit of the water drive reservoir while other wells do not.

Q Help me visualize that. I'm trying to understand a reservoir where some wells feel the benefit of water drive where others don't, and if they are in communication, shouldn't they all feel it?

A Not if it's a fractured reservoir and only the fractures are the conduit by which the water drive does benefit these wells.

Q So that's a tight rock between these two wells and the rest of the reservoir, tight rock meaning they're not in fracture communication and therefore it's a little bit tighter (not clearly understood) pressure from these two wells?

A Yes.

Q I've got a question. Maybe you can't

answer this but, if not, maybe someone with Phillips could.

Would you dispose of E. P.'s water for 10 cents a barrel?

A We have made an offer to E. P. to dispose of their water. I am unsure of what cost that was at, but they have turned down our offer to dispose of their water.

MR. LEMAY: That's all the questions I have..

MR. BROSTUEN: I have some other questions here.

QUESTIONS BY MR. BROSTUEN:

Q I have a question. Perhaps you'd prefer it be answered by your geologist. It has to do with the nature of the porosity of the reservoir.

A Yes.

Q Okay.

MR. LEMAY: Yes, Mr. Kellahin.

MR. KELLAHIN: Thank you, Mr. Chairman.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Let me see if I can understand, Ms.

Courtright, based upon the data you have available to you, particularly the relationship or the importance of the step rate test in understanding what volumes of water you can put in the disposal well at low pressure.

A Yes. sir.

Q I want you to explain it in laymam's words so that I understand the reservoir mechanics of -- of the disposal operation.

A I --

Q We'll -- let me phrase it in my own words and you correct me where I misunderstand the point that you're making.

Am I correct in understanding that we have a reservoir that the formation water is currently present and being produced in most of the wells?

A Yes.

Q Now, are, on any of your displays, other than the E. P. operated discovery well at the high point of the structure, other than that well, do we have all other producing Fusselman wells in the field producing some formation water?

A Yes, all are producing some formation water.

Q As you re-introduce formation water into the Fusselman formation at these low pressures, does this

not work like a waterflood project where you're putting formation water in down structure and whatever fractures were already in the formation, some of which are connected by wellbores in the pool, that formation water re-introduced is simply going to move through the formation again, is it not?

A Yes.

Q Does that exercise, using the pressure rates you anticipate, is that going to create a large pressure differential among any of the wells in the pool so that you're going to have water breaking through and going to what now is a producing well that has low producing water rates?

A No.

Q Explain to me how you visualize the operation of the reservoir and the suitability of using these rates of disposal at this low pressure. Are we going to have Mr. Carr's concern that you're pumping in formation water at high rates and high pressures and you're going to fracture the formations and you're going to dissipate known oil production out of existing wellbores?

A No, sir. There certainly is shown by our step rate test, we will be able to inject at a low pressure, and being able to inject at a low pressure we will remain confined within your injection zone.

Q But are you remaining confined to the existing fracture system in the reservoir?

A Yes, sir.

Q You're not creating new fractures.

A No, sir.

Q In examining the relationship of water breakthrough between what was the fact situation in '81 with the Enserch Well, had water -- had water breakthrough occurred for the No. 4 Well then?

A No, sir, it had not. This well was at -- in excess of 100 barrels a day (not clearly understood).

Q With low water rates?

A Yes.

Q So do we see that now with the Lambirth E. P. No. 7 and No. 8 Well, do they have -- currently experience water breakthrough?

A The No. 8 Well certainly experienced water breakthrough. It was abandoned in excess of 100 barrels per day of water.

The No. 7, as I stated, it has produced water but it is not seen as large quantities as No. 8. This is due to the depletion mechanism of the No. 7 Well.

Q Do you see the introduction of disposed water in the No. 6 Well as creating a problem for increasing the magnitude of water breakthrough for any of the

known production in the field?

A No, sir. As this is a bottom water drive reservoir any introduction of water would only add or lend pressure support.

Q Am I correct, in my own simple way, of understanding this to be like a one well waterflood operation?

A Yes, sir.

MR. KELLAHIN: Nothing further.

MR. LEMAY: Additional questions of the witness?

Yes, Commissioner Brostuen.

QUESTIONS BY MR. BROSTUEN:

Q On your Exhibit Number Three, referring to E. P. Operating Well -- Well No. 7, you show a 7539 barrels of oil from the Penn, I believe. Is the 103,000 figure in the box at the upper righthand corner of that well, or to the right and -- is that the production figures and other data for the Fusselman?

A Yes, that's the cumulative figures --

Q Okay.

A -- while it was in the Fusselman.

Q And this is the well you say is not re-

ceiving benefit of water drive?

A Yes, sir.

Q The gas/oil ratio of that well by my calculations is approximately (unclear) to one. Would -- are -- are you assuming that that is saturation gas drive reservoir or -- for that particular well, what was the drive mechanism in that particular well?

A This was pressure depletion.

Q Pressure depletion.

A Uh-huh.

Q Would you expect the GOR to increase above -- I don't know what the initial GOR was but apparently this is depletion or this is a cumulative GOR, I might say, we're looking at here.

A Yes.

Q I see. You don't have a final GOR.

A No, sir.

Q You don't have that now. Thank you very much.

MR. LEMAY: Additional questions of the witness?

If not, she may be excused.

You may call your second witness, Mr. Kellahin.

R. E. "RICK" HALLE,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Halle, for the record will you please state your name and your occupation?

A My name is Rick Halle. I'm a geologist employed by Phillips Petroleum in Odessa, Texas.

Q Mr. Halle, as a petroleum geologist have you previously testified before the Oil Conservation Division?

A Yes, I have.

Q Would you describe generally what it is that you sought to review for your company with regards to this application?

A I sought to study the area to see if there was a suitable location for a salt water disposal well.

Q Have you completed that geologic review?

A Yes, I have.

Q And have you worked in connection with Susan Courtright's engineering study to evaluate this area in order to find a disposal well?

A Yes, I have.

Q And based upon that study to you have certain geologic conclusions and opinions?

A Yes, sir, I do.

MR. KELLAHIN: We tender Mr. Halle as an expert petroleum geologist.

MR. LEMAY: His qualifications are acceptable.

Q For you as a geologist, Mr. Halle, what were the principal factors or criteria that you were seeking to satisfy for a disposal well in this specific South Peterson Fusselman Field?

A I was looking for a well that was structurally low. I was looking for a well below the oil/water contact, and I was looking for a well that had good porosity and permeability so the well would accept large amounts of fluid at low pressure.

Q Did you find such a well when you examined the available wells in the area?

A Yes, I did.

Q And which well is that?

A The Lambirth A No. 6.

Q Does that represent your own personal geologic opinion as the best suited Phillips well for disposal of produced Fusselman water?

A Yes, sir, it is.

Q Describe for us how it meets each of the criteria you've established for a suitable disposal well.

A The Lambirth A No. 6 is in the north edge of the South Peterson Field, on the down dip edge. The top of the Fusselman is 32 feet low to the highest well, which is the Lambirth No. 1 drilled by Enserch down in the southwest of 31.

The zone that we propose to inject into is the Lower Fusselman porosity zone, a loosely defined zone, not a formation, and on this horizon the well is 148 feet low to the highest well in the field on that top.

The well was tested during the step rate test and swabbed all water, which puts it below the oil/water contact, and the injection test says it will take large volumes of water at no pressure, just no surface pressure.

And also the porosity I correlated across the field is very continuous where it hasn't been eroded, and so the water will have plenty of room to move out away from this wellbore.

Q To illustrate your work you have prepared a structure map which is Exhibit Number Fifteen?

A Yes, sir, it is.

Q And you also have prepared an east/west

cross section which is Exhibit Number Seventeen, I believe?

A Yes.

Q And then there is a north/south cross section which I think is Exhibit Number Sixteen.

A That's correct.

Q Let's turn to the structure map, Exhibit Number Fifteen, Mr. Halle.

First of all, help us to understand the wells that you've selected to display on the east/west cross section. How is that identified on Exhibit Fifteen?

A The wells on the east/west cross section are the wells connected by the blue line on the structure map. They pass through the proposed injection Well No. 6-A.

Q All right, and then the wells that are on the Exhibit Fifteen with the red line connecting them represent what?

A That is the line of section for the north/south cross section and again it crosses through the proposed injection well.

Q Are you satisfied, Mr. Halle, that you had available sufficient available geologic information from which to construct a structure map of the Fusselman for this reservoir that you had confidence in?

A Yes, sir, I had.

Q Is the degree of well control and data available sufficient for you to draw conclusions about where the oil/water contact is, for example?

A Yes, it is.

Q And about where the optimum location is for a suitable disposal well?

A Yes.

Q Describe for us what you as a geologist see and conclude from an examination of the structure map.

A I see that the South Peterson Field is a broad nose. The crest of the nose is back to the southwest section -- portion of Section 31 and that the structure drops off to the north and also the west and the east.

The Fusselman is truncated on the south so this cross section through this structure map also has a few data points on the Granite where the Fusselman is completely missing and the base of the Penn unconformity sits directly on top of the Granite.

Q When we turn to a discussion of the cross sections, please select whichever one you want to work with first, either north/south or east/west, which would you prefer?

A I think the first thing we should do is just genetically describe how both cross sections are put

together.

Q Let's do that.

A They're hung on the subsea datum of -3200 feet, so the cross sections depict the true structural position of formations in each well.

The correlations on this -- these cross sections include the Cisco lime in the Pennsylvanian, the uppermost formation.

The wiggly line across the center of the cross section is the base of the Pennsylvanian and top of the Fusselman and some places the top of the Granite. It's an unconformity of the surface.

The next correlation down is the Lower Fusselman porosity and this is the zone we intend to inject into. You can see it's colored red, the porosity in the Fusselman is colored red and this is the best porosity in the Fusselman-Montoya and you can see it's continuous across the cross section, except on the north/south cross section, when you get over near Mr. Mueller, the Fusselman is missing in the last well.

Other things that are noted on these cross sections would be the perforated zones. The blue perforations are perforations in the Pennsylvanian. The orange perforations are in the Fusselman-Montoya. The red perforations with the white stripe are in the Granite.

The green block in the Phillips A No. 6 in both cross sections is the interval that we have perforated and proposed as our injection zone in this Lower Fusselman porosity.

Some of the perforations are labeled nonproductive. They either tested water or tested tight; recovered no fluid at all.

Some of them are labeled P & A, which stands for produced and abandoned. These wells produced from those perforations and have subsequently been plugged back to shallower zones.

And the other perforations that don't have any labeling next to them are the current perforations in those wells.

At the bottom of each well log there's IP's for those perforations.

Q Describe for us how you have made an investigation of and determined what in your opinion is the original oil/water contact in the reservoir.

A I took data from our well files, from the various tests on the perforated intervals, and put together a table which is this table down here, hand that out.

Q Exhibit Number Eighteen.

A On this I've compiled the well location,

the well name -- we've got the well name, well location, year and month it was completed, the Fusselman top, the Fusselman isopach, and then on the right it's the detailed tests.

I don't think we want to go into a lot of detail pulling this apart, but we'll take out the specific tests that show you where I feel the oil/water contact is.

The deepest, the lowest water-free completion in the Fusselman formation in South Peterson Field is in the EPO No. 9 Lambirth.

Q I think that's on Exhibit Number Seventeen and it's the log on the far left of that display, and the number 7, then, represents the deepest water-free oil that you found in the reservoir?

A Yes, sir, that's correct.

Q And what is the subsea footage for that?

A The bottom of those perforations are at -3447.

The 1200 foot offset, east offset to that well, is the Phillips No. 5. It's in Section 30. It's the next well on this same cross section. And that well tested the Fusselman with the bottom of the perforation -- the top of the perforation being -3454 and it swabbed 770 barrels of water.

Q And what does that tell you?

A That tells me that -3454 is below the oil/water contact and -3447 is above it.

Q Okay, for the -- for the No. 5 Well we find water at -3440 --

A 54.

Q -- 54, and in the No. 9 Well the deepest we can find oil is -34 --

A 47.

Q -- 47. So what does that tell you?

A That tells me that we bracketed the oil/water contact in these two wells.

Q Now where is there structural position on the structure map, Exhibit Fifteen? Where would you find those two wells?

A We'd find them off on the northwest edge of the field. The structure on top of the Fusselman is pretty flat in these wells and the difference in structure of these perforations is relative to the position of the porosity.

Q Now this is the original oil/water contact.

A Yes.

Q Within this range.

A Yes.

Q Approximately what time in the life of the reservoir are we given up here?

A These wells were tested in 1980. The original wells were tested in 1978 and '79.

That alludes back to the question that Commissioner Lemay asked about are there two fields. If you split the Fusselman into two bands, say that the Upper Fusselman porosity is different from the Lower Fusselman porosity, we do see differences in the way that the water has encroached on these wells.

Q Now this -- the ones we've talked about for 4 and 5 represent what might be characterized as Upper Fusselman.

A Yes, sir.

Q Have you attempted to frame with actual production information what could be the range of the original oil/water contact in what is called the Lower Fusselman?

A Yes, in the Lower Fusselman porosity, the lowest water-free completion was the Phillips No. 1 Lambirth A at -3436.

Q Do we have that on any of the cross sections?

A No, that well isn't on these cross sections.

Q Okay.

A But --

Q Where do we find that on the structure map, Exhibit Fifteen?

A In Section 31, the northwest of the southeast.

Q It says -3404 on the contour map?

A Yes, that's the top of the Fusselman.

Q All right, and tell me again the number at the lowest, what's the footage?

A The bottom of the perforations in that well are at 34 -- -3446. It was completed with no water.

Q At -3436 is the lowest point in the Upper Fusselman that we get oil without water?

A That's right.

Q All right, how have you bracketed that?

A There's a well just north of the EPO No. 3 that perforated an interval that went down to -3441. It was completed for 25 barrels of oil and 12 barrels of water and it produced for three months. Unfortunately, those three months aren't -- aren't in the production books. They've gotten mixed up somehow, so unfortunately we don't know what the oil/water ratio was but that well was abandoned then and we can only assume that since it had very little pressure, it was very near the oil/water contact.

And that well is on the cross section.

Q So at -3442 what do we find in that well?

A 25 barrels of oil and 12 barrels of water.

Q So at approximately that point is the transition, then, between the oil/water contact originally in that well?

A Yes, it would be the closest to the oil/water contact.

Q And you've gone through the rest of the well information that's shown on Exhibit Eighteen?

A Yes, I have.

Q And using, then, the actual production information tried to determine the original oil/water contact in the reservoir?

A Yes. The oil/water contact that I propose is -3450, which is the light blue line that -- horizontal line on these cross sections.

Q When we get to -3450, the proposed disposal well, the Lambirth A No. 6 on cross Section 17, where does that put your proposed disposal perforations in relationship to the original oil/water contact?

A 50 feet below that contact.

Q When we look at the closest offsetting

production at any point in time in the reservoir to the proposed disposal well, do you have logs of those wells on Exhibit Number Seventeen?

A Yes. The closest wells to our proposed injection well would be the Enserch No. 8 Lambirth and the Enserch No. 7 Lambirth.

Q When we go to the Enserch No. 8 Lambirth, and that's the one that's to the left of the disposal well on Exhibit Seventeen --

A Yes, sir.

Q -- I have here with a pointer, and the blue line shows the original oil/water contact?

A Yes.

Q Have you re-examined the available data including the logs to see whether or not in your opinion there are represented zones below the original perforations that could now at this date come back and be perforated and produce hydrocarbons?

A I've looked at that and it's my feeling that -- that, first that were originally done in the well have effectively drained all that porosity and there is no barrier between perforations and lower porosities, and any porosity below the -3450 would be wet.

Q When did Enserch abandon the Fusselman production in the No. 8 Well?

A I believe that was 1987, is when they recompleted it to the Penn.

Q What has happened to the original oil contact, oil/water contact in that wellbore as a result of the production? Where -- where is that oil/water contact now?

A That oil/water contact has moved up to across the perforated zone and essentially flooded out the oil reservoir.

Q Do you see as a geologist any potential that the disposal of produced Fusselman water in the disposal well as you propose, is going to migrate over to the E. P. No. 8 Well and prematurely abandon any recoverable hydrocarbons in that particular area?

A No, sir. The well has already been abandoned and because of high water cut, and I don't believe our water will have any effect on that at all.

Q Let's go the other direction and look at the E. P. No. 7 Well.

A Yes, sir.

Q The -- what has been the history, refresh our memory on the history of the E. P. No. 7 Well.

A That well was drilled about 50 feet into the top of the Fusselman and was completed in a 3-foot stringer of Fusselman porosity that produced 103,000 bar-

rels of oil and 51,000 barrels of water.

The curves that Ms. Courtright has shown you show that that well depleted and we can also see that the oil/water contact was touched in the bottom of that wellbore, and even though there probably is lower Fusselman porosity below the bottom of this wellbore, it would be wet.

Q Would you as a geologist recommend to E. P. that they deepen the No. 7 Well through the full extent of the Fusselman formation?

A No.

Q Why not?

A Because anything they would find would be wet.

Q Is it possible for a geologist to examine logs and through log calculations come up with a number that tells them the water saturation based upon log analysis?

A It's difficult in this reservoir. These numbers for our No. 6 Well said there was 60 percent water saturation; the lease logged 100 percent water. So the difficulty is in determining just where -- at what water saturation would a well produce water and at what saturation would it produce oil, some oil, and therefore we use production numbers from actual perforations instead of

using log calculations.

Q Based upon log calculations of water saturation, what did you calculate to be the water saturation for the interval to be used for disposal purposes in the disposal well?

A Our computer log shows 60 percent.

Q 60 percent would be 60 percent water and potentially 40 percent hydrocarbons?

A Right, yes, sir.

Q In fact, when this was swab tested and actually tested in those perforations, it produced nothing but water?

A That's correct.

Q What does that tell you about the ability to take log analysis and come up with water saturation numbers that are reliable for establishing an oil/water contact in the reservoir?

A Water saturation numbers alone wouldn't be as reliable as production data.

Q When we look at the Lambirth No. 8 Well, what was the net thickness of the Fusselman formation that was felt to be productive through that log?

A The porous interval is barely 100 feet thick.

Q As a result of that porous interval,

what was the total cumulative production out of the Fusselman before they abandoned the zone?

A Let's see, this well produced 42,000 barrels of oil and 448,000 barrels of water, 10 times as much water as the oil.

Q What does that tell you as a geologist in relation to the water/oil mechanism of the reservoir? What's occurring?

A The reservoir has been flooded out by a water drive.

Q We asked Ms. Courtright her engineering opinions with regards to the mechanics of the reservoir. I want to ask you as a geologist, sir, if you see the fracture system of the reservoir such that we should be concerned that the disposal of water in the volumes Phillips proposes at the pressure rates they propose is going to, in your opinion, cause fracturing of the formation so that your disposal is going to prematurely fracture into known proven hydrocarbon production.

A I don't believe that it -- that water that's put in at a hydrostatic head is -- is going to do anything to this reservoir at all. It's a very sucrosic dolomite. It is already fractured and seen there is a lot of structure in it. It's a thin zone that's been draped up over a high that's already naturally fractured and broken

by its long history and now the top of it is sealed over with basal Pennsylvanian shales and that's what's trapped the hydrocarbons in this formation. We do see a couple wells that don't seem to have this water support. They would be the Enserch No. 7, our No. 4, and the Enserch No. 9. Those wells all were completed in the upper part of the Fusselman and not into into the porosity that we intend to inject into.

Q When you look at all the wells that you displayed on No. 17, do we find any current perforations that are correlative to the disposal perforations?

A The current production up structure correlates in a stratigraphic sense but is structurally so much different that we won't affect the up dip production.

Q Structurally, then, there are no perforations that exist at a lower structural point in the reservoir than your proposed disposal interval?

A No, there are no -- no perforations anywhere near this structural level.

Q Is that true for the entire reservoir if we can look at Exhibit Sixteen?

A There are no producing intervals below -3450 and our proposed injection zone is well below that.

Q Have you examined each and every of the available logs to determine whether or not there is unper-

forated potential in the Fusselman formation that might be prematurely watered out by disposal in this formation?

A Yes, i have.

Q And what have you found?

A There are no potential porosity zones that have been watered out.

Q What then, Mr. Halle, is your ultimate geologic conclusion about the appropriateness and suitability of using the Lambirth A-6 Well as a disposal well for the produced Fusselman water?

A It's my conclusion that the Phillips Lambirth A No. 6 is the best disposal location in the field and it has good porosity, structurally low and far removed from the other wells and a good continuous zone so that it would take the water and it's our conclusion that -- that this is indeed the best well for us to use to dispose of our water.

MR. KELLAHIN: Mr. Chairman, that concludes my examination of Mr. Halle.

I'd like to move the introduction of his Exhibits Fifteen through Eighteen.

MR. LEMAY: Without objection Exhibits Numbers Fifteen through Eighteen will be admitted into the record.

Cross examination, Mr. Carr?

MR. CARR: Thank you, Mr. Lemay.

CROSS EXAMINATION

BY MR. CARR:

Q Mr. Halle, in preparing for today's case did you happen to review the testimony that was presented to the Division in 1981?

A I looked at it several months ago but I haven't looked at it recently.

Q Do you recall testifying for Phillips at that time that simply injecting on vacuum couldn't fracture the formation?

A I don't recall that.

Q Do you recall testifying at that time that even if we reduce the injection rates that there was still a concern on Phillips part that there could be a breakthrough of water into offsetting wells?

A I'm sorry, Mr. Carr, I do not recall.

Q In preparing for the case, did you happen to review the core data?

A I looked at descriptions of two or three of the cores that we (unclear).

Q And did they indicate that the, that at least in those cores there was vertical fracturing in this

reservoir?

A Yes, there is some, some mention of vertical fracturing.

Q Do you have an opinion as to whether or not this reservoir is fractured?

A I believe it is.

Q And doesn't that in fact increase the porosity and permeability that you need to have a good disposal well?

A It certainly increases the permeability.

Q Would you expect the fracturing to be present throughout the reservoir?

A I have some reservations on that in that three of the wells don't seem to behave the same as the others.

In the -- in the main porosity zone, I would say, yes, that it is.

Q In the main porosity zone?

A In this Lower Fusselman porosity as I've got (unclear) --

Q That's the injection interval?

A That is the injection interval.

Q And that does correlate with zones from which in the past, at least, hydrocarbons have been produced.

A At the proper structural positions.

Q You say it does correlate with those?

A Yes.

Q When you say three wells didn't perform like other wells in the pool, are you contending -- and I'm just asking to clarify what your testimony is here -- was it your testimony that in your opinion there are two separate fields here?

A No, I don't see any need for separate fields. The -- all the wells are in the Fusselman formation. There's nothing really unique other than that some wells seem to have been supported by a water drive and some wells seem to be depleting by pressure depletion.

Q In your opinion as a geologist do you believe that those other three wells are not in communication with the wells in the main part of the reservoir?

A I see that what looks like the original oil/water contact may have been shared. They may be not as well connected.

Q Your understanding of this reservoir is based upon, if I understand you, the belief that the reservoir drive mechanism is a water -- bottom water drive, is that correct?

A That's correct.

Q And that is that it's moving up the

structure.

A Yes.

MR. CARR: That's all I have.

MR. LEMAY: Thank you, Mr. Carr. Additional questions of the witness?

Commissioner Brostuen.

QUESTIONS BY MR. BROSTUEN:

Q I believe you testified that you have -- the porosity of the sucrosic dolomite and it's fractured. Apparently the -- strike that.

The No. 7 Well in the southeast corner of Section 30, this is an Enserch well, is it not?

A Yes, sir.

Q This is the one I believe was testified was not in communication with the fractures in the -- in the other parts of the pool.

A It doesn't seem as well connected.

Q So it would appear that there's a substantial difference in the permeability to the fractures and the permeability of the sucrosic dolomite.

A The No. 7 Well appears to have a separate, perhaps a separate porosity band in this upper part of the Fusselman above the lower formation here, Fusselman porosity, and it may not be connected as well.

Q Does the intergranular porosity seem to be comparable to the (unclear) porosity in the other wells in the pool?

A All we have to go on in that well is a log and certainly the porosity looks very good in that, in that log. We don't have a core in that well.

Q So it would appear that we have a higher capacity permeability through the fractures than -- than through the intergranular porosity of the -- of the sucrosic dolomite.

What do you think would be the effect of -- strike that.

I believe it was previously testified to that injection pressures by gravity would approach 1500 psi. Do you have any idea what the fracture pressure of the formation is?

A No, I don't.

Q There's been no attempt to -- to induce fractures in the porosity in the reservoir.

A Not to my knowledge, we haven't.

Q Do you have any idea what the present reservoir pressure is in the reservoir?

A I don't recall that figure.

Q I recall it being testified to (unclear) information.

What do you think the effect would be on those unfractured blocks, or the blocks separated by the fractures by pressuring up to 1500 psi by water injection? Are you going to confine fluid within the intergranular porosity to those blocks or would it move it out of the blocks into the fractures?

A You're asking if -- if I think that the lower injection zones that we're injecting into, if we exceed 1500 psi --

Q Yes.

A -- if I think it will go across the apparent boundary between, say, our 6 and their 7?

Q I'm saying -- I'm not saying between R-6 and R-7. (Unclear) the entire reservoir is fractured. You have intergranular porosity and you have -- then you have fracture porosity, the fracture porosity being higher capacity, is it going to absorb most of the water being injected through your proposed injection Well No. 6. I'm asking what would be the affect of that increasing the pressure on the fractures to the fluids that are presently existing within those blocks which are not fractured, and that could be any place within the reservoir.

A Yes.

Q I'm waiting for an answer.,

A I don't -- I don't really know what --

what that pressure -- whether that pressure would break open more fractures or not.

The intergranular porosity is very good. There are some very high producing rates from these wells, exceeding 4-or-500 barrels a day. How much of that was intergranular and how much of that was fracture, we don't know, but the fractures that already exist coupled with the existing granular porosity, I think would handle the pressures that we're talking about and you wouldn't be propogating new fractures.

Q Well, that was not my -- not my concern we're going to be propagating additional fractures because of the already fractured nature of the rock; however, my question is, are you going to be confining fluids to those unfractured blocks separated by the fractures or is that fluid going out with the -- if you pressure up the fracture porosity, the fractures themselves to 1500 psi?

That's my question.

A Okay. Fractures in those blocks that already have intergranular porosity, yes; say typical of what we see in our (unclear) well, I think the porosity is good enough where you'll put water also into the intergranular porosity and not confine it to the fractures.

Q Thank you very much.

MR. BROSTUEN: That's all I

have.

QUESTIONS BY MR. LEMAY:

Q A couple quick ones. Mr. Halle, did you run any samples in the field at all?

A No, sir, I haven't.

Q You did look at a couple of cores, I guess, you testified earlier, or descriptions of those cores.

A Just descriptions; I haven't seen any rock.

Q How do you feel -- (not clearly understood) correlation of Lower Fusselman porosity, do you think there's a possibility that without any sample control that that may be random development of porosity? Do you feel that's a defineable zone that we could correlate?

A It's a regional zone that is picked in other fields and in other areas. There is over a wide regional area well developed porosity in this Lower Fusselman-Montoya interval and I feel comfortable with it. Like I say, it is to some degree random porosity and it's not the kind of thing that you're going to call a really good marker, and you can see differences from well to well, but in a general sense, if you sit back and look at the red, there is more porosity in that lower part of the formation

and when you have a well deep enough to penetrate the Granite and you have a good stratigraphic control under it, and that makes it more comfortable.

When you get a well like the No. 7 that didn't penetrate very much of the Fusselman, then you can't be sure where you are because the gamma ray isn't a very good correlation tool in the Fusselman in this area.

Q So you can't rely on what would be the gamma ray characteristics to fit the whole Fusselman porosity, so you're saying you're really picking it on the basis of the highest porosity in the section, as well as correlating up from the Granite (unclear).

A That's right.

Q One other question. Are you familiar with the carbonate reservoirs in general in southeast New Mexico?

A Yes.

Q Could you characterize any statement, like they have -- they're good reservoirs and have good reservoir characteristics? Would you say that most of them are fractured, a lot of them are fractured, all of them are fractured, it's rare to have them fractured?

A I'd say it's very common in dolomites to have a fractured reservoir. It's real dense rock. In this case it has a lot of porosity and it's been exposed prob-

ably to some fresh water in its lifetime and I imagine some of this porosity is produced by -- by that.

Q Would you say it's rare to find a carbonate, especially dolomite, that is a reservoir rock in southeast New Mexico, the Permian Basin, that is not fractured?

A Yes, I'd say it's rare.

MR. LEMAY: Additional questions of the witness?

If not, he may be excused.

And I think we'll take a break here. Is that the end of your presentation, Mr. Kellahin?

MR. KELLAHIN: Yes, sir.

MR. LEMAY: Be back at 1:00 o'clock and hear your side, Mr. Carr.

(Thereupon the noon recess was taken.)

MR. LEMAY: Let's reconvene with the other side, Mr. Carr.

MR. CARR: At this time, Mr. Lemay, we would call George Faigle.

GEORGE A. FAIGLE,

being called as a witness and being duly sworn upon his

oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q Would you state your full name for the record, please?

A My name is George A. Faigle.

Q Mr. Faigle, where do you reside?

A Midland, Texas.

Q By whom are you employed?

A Enserch Exploration.

Q What position do you now hold with Enserch?

A I am the District Development Geologist for the West Texas Production District.

Q Have you previously testified before the New Mexico Oil Conservation Commission?

A No.

Q Would you briefly review your educational background and then summarize your work experience for the Commission?

A I have a BS degree in geology from Syracuse University. I have an MS degree in geology from the University of North Dakota.

Geologic work experience consists of 25

years in the Permian Basin, which breaks down companywise as nine years with Texaco, four years with Coastal States, seven years with C & K Enstar, three years as a consultant, and two years with Enserch.

Q Does your geographic area of responsibility for Enserch include the area in which is located the South Peterson Fusselman Field in Roosevelt County, New Mexico?

A Yes.

Q Are you familiar with the application that was filed in this case on behalf of Phillips Petroleum Company?

A Yes.

Q Are you familiar with and have you made a study of the South Peterson Fusselman Field?

A Yes.

MR. CARR: We tender Mr. Faigle as an expert witness in petroleum geology.

MR. LEMAY: His qualifications are acceptable.

Q Mr. Faigle, initially would you simply state what Enserch is seeking by its appearance and participation in this case?

A Enserch seeks to prevent the loss of Fusselman oil reserves due to premature water encroachment

caused by water disposal into the reservoir.

Q Okay. Does Enserch request denial of the Phillips application?

A Yes, we do.

Q Have you prepared certain exhibits for presentation at this hearing?

A Yes.

Q Would you refer to what has been marked as Enserch Exhibit Number One? That's the first page behind the index exhibit in the blue booklet; identify this and explain to the Commission what it shows?

A Exhibit Number One is a simple geographic location plat. It shows the location of the Peterson South Field area, indicated by the red dot, and for orientation we've labeled the New Mexico/Texas state line and at the top of the map the Town of Portales and at the bottom of the map the Town of Tatum.

It's for orientation purposes only.

Q Would you now refer to Enserch Exhibit Number Two, which is a stratigraphic cross section? This is contained in the pouch in the back of the exhibit book.

A Exhibit Two is --

Q Wait just a second until they have a chance to get it out.

Initially, Mr. Faigle, on the bottom in

the lower righthand corner it says that -- it bears the name L. Buckner. Will you identify who that is?

A L. Buckner is (unclear) Buckner. He is a development geologist in the West Texas Production District, who works under my supervision.

Q And have you reviewed this exhibit and from your own information can you testify as to its accuracy?

A I have reviewed it and it is accurate.

Q Would you go first, I think in reviewing the exhibits, start with the index map and then working from that review what this cross section depicts.

A Okay. Referring to the index map, A-A', on the righthand side of the cross section we start with the Phillips No. 6-A Lambirth Well. This is the well that has been proposed as a water disposal well.

The zone of disposal is highlighted in blue with a red arrow pointing toward it.

Directly to the west we come to the next well, the Enserch No. 8 Lambirth and then turning south we go through the Enserch No. 10 Lambirth, the Phillips No. 2-A Lambirth, and the Enserch No. 1 Lambirth.

These are on the cross section to illustrate typical Fusselman producers in the South Peterson Field.

Also notice that there are both test history and completion histories associated with each well on the cross section.

There are some formation top picks on the cross section and on the righthand side, again, starting from the bottom up we have the Basement, or Granite with an unconformity over it. Overlaying the unconformity is the Fusselman section which we internally divide into the Upper and Lower Fusselman, which is overlain again by an unconformity and the Lower Penn section.

I'd like you to note the correlation line through the well that's highlighted in green. This is what we call the Lower Fusselman. It's the major Fusselman reservoir in the field and I think it illustrates quite clearly that the zone proposed for water disposal is in fact the major producing reservoir in the field.

Q Does this zone correlate not only in the northern portion of the field but as the cross section extends down toward the A end of the cross section?

A Yes. As you follow the green line across you can see it is the same zone as the discovery well is producing in.

Q Now, this exhibit only shows the Fusselman interval, is that correct?

A Yes.

Q Is it -- does it show the Pennsylvanian?

A The very lower part of the Pennsylvanian above the top wiggly line is obvious (unclear). There's no correlation. I've made no correlation lines within the Pennsylvanian.

Q That's not the purpose of the exhibit.

A No, the purpose was to address the Fusselman only.

Q And the Wolfcamp would be where, up the hole from this?

A That would be either higher in the section that isn't even shown on these logs.

Q Are you ready now to move to Enserch Exhibit Number Three?

A Yes.

Q Would you please identify that for the Commission and this is also an exhibit that is in the pouch on the back of the folder.

A Exhibit Number Three is a structure map in the South Peterson Field area on the top of the Lower Fusselman. I'm sorry, on top of the Upper Fusselman.

If you'd refer back to your cross section it is the unit labeled Upper Fusselman directly beneath the wiggly line of the unconformity. That is what this map

is made on.

In addition to the structural configuration that it shows on the Upper Fusselman the relationship of the wells in the field are shown, where they are in relation to each other geographically. It shows the -- high lighted with an arrow the Phillips No. 6-A Lambirth Well, which is the proposed disposal well.

There is also a production color code legend which identifies what each well, what zone each well is producing in.

Q All right, now, Mr. Faigle, would you move on Enserch Exhibit Number Four?

A Exhibit Number Four is a structural map in the South Peterson Field area on the Lower Fusselman. Referring back to the cross section, this would be the horizon that is highlighted in green on the cross section and it's the mainpay, main Fusselman pay in the field area.

It shows once again the relationships of the wells to each other and what zones they're producing out of, where the proposed injection well is.

In addition it shows the potential we feel is in existence between the Phillips 6-A Lambirth Well and the Enserch No. 8 Lambirth Well.

Q This is the potential for --

A This is the potential for structurally

trapped oil in the Lower Fusselman section.

Q All right. Now, Mr. Faigle, if we could move on to what is Enserch Exhibit Number Five and if you would identify that for the Commission and then review what it shows.

A Exhibit Five consists of four pages. They all relate to a core description of the Fusselman taken from the Phillips No. 2-A Lambirth Well.

If you'll refer to your cross section again, the Phillips No. 2-A Lambirth Well is on it and the cored interval this description fits is highlighted on the well as the second core interval No. 2 down in the main pay.

Looking at the core description, the first page is a visual description of the core. Refer halfway through the page to Core No. 2. This is the part of the core that's the Fusselman and please note the occurrence of the words "highly fractured", "large vertical fractures", "many vertical fractures".

In other words, the person who described this core saw fractures that were worthy of note several different places.

The next three pages are a Core Lab analysis of the same core. Core Lab, if you're not familiar with them, are an outside company that does nothing but analyze cores for us.

Refer once again to Core No. 2 and you will see highlighted the letter F, which referred to on the abbreviation list, F equals randomly oriented fracture. So here are two different sources that consider this core to be highly fractured.

Q What is the significance of this data concerning fracturing in this core?

A Fracturing in a core to me indicates that we have a highly directional permeability.

Q And what would this highly directional permeability mean in terms of the rate at which an area might be affected by the injection of water?

A Injecting water into a highly fractured reservoir, the water is going to seek the path of least resistance. We're looking at fractures which could have permeabilities in the darcy range versus matrix, which has permeability in the millidarcy range. The water is going to seek the path of least resistance and it's going to flow up these fractures at a rapid rate and in a large volume rather than try to seek the inter-crystalline (unclear).

Q Now, Mr. Faigle, you were present when Mr. Halle testified this morning. Do you concur with him that the injection interval is down structure from the other producing wells or wells that have produced in this formation?

A Yes.

Q Does the presence of the fracturing in this formation tell you anything about what might occur as a result of injection in this down structure well?

A Yes. Injecting into this fractured reservoir, the injected fluid is going to seek the path of least resistance and it's going to follow it to its termination. If one of these fractures runs from their injection well to the No. 1 Lambirth, for example, we could see injected water in our well in a matter of weeks.

Q Even though that's up structure.

A Certainly.

Q Now, you were also present when Mr. Halle testified about the reservoir drive mechanism being a bottom water drive mechanism, were you not?

A Yes.

Q You also were present when he talked about an oil/water contact in this reservoir.

A Yes.

Q Do you concur with the conclusions he reached about the oil/water contact?

A The oil/water contact in my opinion is slightly higher than he indicated. We keep the oil/water contact at about -3425 plus or minus.

Now, the plus or minus comes about be-

cause this oil/water contact is not a flat surface. We are -- oil/water contacts in carbonate reservoirs just do not behave that way. A carbonate reservoir is extremely variable rock.

The case that was described to us this morning is an ideal situation in a homogeneous reservoir. The carbonate rock we're dealing with out here is not a homogeneous reservoir. It has not addressed certain other problems, such as the presence or absence of fractures and since we have established pretty well that there are fractures here, it didn't address this. It hasn't addressed the vari-ous producing rates at different wells and the coning prob- lems that they can bring about. It hasn't addressed the in-tegrity of the cement job behind the casing. And it also hasn't addressed the pore throat geometry that you encounter in carbonate.

So a flat oil/water contact is an ideal case in a homogeneous reservoir and I just don't feel we are dealing with that in this field area.

Q Do you believe the existence of the oil/water contact where you place it would preclude the existance of recoverable reserves in the Fusselman in wells that offset the proposed injection well?

A Please repeat the question.

Q Do you believe that the existence of

this oil/water contact would preclude the existence of recoverable reserves in the wells that offset the proposed well, the pro- posed disposal well?

A Could you rephrase your question?

Q Are the wells offsetting this necessarily going to be wet because of the oil/water contact?

A No.

Q Do you believe that there -- is it possible that in the wells that offset the proposed disposal well there could be recoverable reserves in the Fusselman?

A Yes. That's where the plus or minus comes in in the oil/water contact I stated. It's an individual case that you have to look at each case.

Q Do you believe that this is just a reservoir where the drive mechanism is simply a bottom water drive?

A In a very general sense it's a bottom water drive but the top of your bottom water drive is not a flat plane. It's very irregular. It's at different subsea elevations, depending on the -- the conditions I mentioned earlier.

Q What are the general conclusions that you have reached based on your geologic study of the reservoir surrounding the proposed disposal well?

A The first conclusion is that the pro-

posded injection zone is indeed the main producing horizon in the field and secondly, that the presence of fractures in this formation is going to make the passage of fluids a very vari-able condition. In other words, it's not -- they're not going to go out in a sphere. They're going to go out radi-ally in fingers. They're going to follow the fractures and
they could end up in unknown places in very short order.

Q Do you believe that injection as proposed by Phillips could tend to reduce the recoverable oil in this pool?

A Yes.

Q Will Enserch also call an engineering witness?

A Yes.

Q Were Exhibits One through Five prepared by you or compiled under your direction and supervision?

A Yes.

MR. CARR: At this time we would move the admission of Enserch Exhibits One through Five.

MR. LEMAY: Without objection Exhibits One through Five will be admitted into evidence.

Mr. Kellahin?

MR. KELLAHIN: Thank you, Mr.

Chairman.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q The line of cross section that you've given us on the structure map for both the Upper Fusselman structure and the Lower Fusselman structure, is that the cross section you've shown us as Exhibit Number Two?

A Yes.

Q That is a stratigraphic cross section, is it not, Mr. Faigle?

A Yes.

Q Did you prepare any structural cross sections like Mr. Halle did?

A Yes.

Q And do you have those available with you today?

A Yes.

Q Do you show structural cross sections that are materially different from Mr. Halle's structural cross sections that he presented earlier this morning?

A Yes, as far as the correlation of the Upper Fusselman. The Lower Fusselman, it is my opinion we have some differences of opinion as to where that pick is.

Q In examining his structural cross sec-

tions that he presented, do you have any material difference of opinion with regards to any of the data presented with the exception of the water/oil contact that you described for Mr. Carr awhile ago?

A I can't give you a yes answer to that. There were entirely too many wells, entirely too much information, and I haven't had a chance to examine it with the kind of detail I need to give you an answer.

Q But you have independently of Mr. Halle examined the structural relationship of the wells one to another.

A Yes.

Q And based upon that examination you have found a general oil/water contact that is higher than the one that he found originally in the reservoir.

A The current oil/water contact --

Q I misspoke. The original oil/water contact that you have determined existed in the reservoir, is that at the same general reference point that Mr. Halle found in the reservoir originally?

A I have not researched the original oil/water contact in this field. What I was concerned with is the present oil/water contact.

Q All right, let me make sure I didn't misunderstand you. When you give a -3425, give or take,

that is your approximation of what is the current oil/water contact?

A Yes.

Q Now, do you find that subsea distance located on the proposed Lambirth A No. 6 Well?

A It can be calculated very easily. -3425 on the Phillips Lambirth A-6 Well equals 7818 (unclear).

Q Mr. Faigle, I'd like to use Mr. Halle's Exhibit Number Seventeen and direct you, sir, to that portion of the structural cross section in which he has depicted the Phillips disposal well.

Where in relation to the blue line that he has placed on his display as the original oil/water contact in the disposal well did you think that oil/water contact is now?

A 7818 drilling depth.

Q The current oil/water contact, then, in your opinion in the disposal well is correlative to the perforations in that well which Mr. Halle placed in the Upper Fusselman. Is that correct? Aren't those perforations?

A Yes, but Mr. Halle and I disagree with where that unconformity is.

Q When we look at the E. P. No. 8 Well, Mr. Halle has placed the original oil/water contact on the display at this portion identified by the blue line. Where

in your opinion is the oil/water contact in that well?

A The Enserch No. 8 Lambirth, -3425 equals 7822 drilling depth.

Q All right, sir, would you take your pencil and draw a line on the log showing approximately where you think the current oil/water contact is. Okay, and would you do the same for me, sir, on the E. P. No. 7 Well, which is the well to the right of the disposal well on Exhibit Number 17.

A On the No. 7 Well, -4325 equals drilling depth 7816. I'm sorry, I can't read those numbers.

Q That looks to be 7800.

A Okay, 7800.

Q Thank you, Mr. Faigle.

MR. KELLAHIN: Mr. Chairman, Mr. Faigle at my request has with a pencil located on each of those three logs on Exhibit Number Seventeen a line that shows what in his opinion is the approximate current oil/water contact, or, I'm sorry, the top of the water on each of those logs.

MR. CARR: I would object to the restatement of his answer. I believe Mr. Halle's answer was that's where he would calculate it and he calculated plus or minus. He didn't say that's where it was. He said that's what he would calculate plus or minus and I

think there's a real distinction there.

Q Subject to the qualification Mr. Carr has placed on you, is that your best calculation of the -- of your opinion of the approximate current oil/water contact in each of those wells?

A I need to clarify that. That's the equivalent zone. When we're speaking of an oil/water contact at -3425, plus or minus, it refers only to the Lower Fusselman, and on Mr. Halle's contact that this would be this (unclear) right here. It does not apply when -- once you get up here you're out of the Lower Fusselman. All this section in this well is wet because it's simply below the oil/water contact.

The oil/water contact doesn't apply until you get this zone above it. Then you can draw a line there.

Q In making your analysis of the oil/water contact, do you find that Mr. Halle is going to be disposing of produced water below the oil/water contact in his proposed disposal well?

A Yes.

Q And will he be disposing of produced water at an interval that's below the oil/water contact in the No. 8 Well?

A Yes.

Q And will he be disposing of water in the disposal well at a point that is lower than the oil/water contact in the No. 7 Well?

A Yes.

Q In comparing the two structural maps that you have presented, Exhibit Number Three and Four, do we find two separate and distinct reservoirs that you can separate between the Upper and Lower Fusselman?

A There's conflicting information on this. You cannot positively separate these two reservoirs all over the field. Some wells you get information that there are separate reservoirs; in other wells you just don't have enough information to make that determination in that particular well.

Q When you examine the available geology for the No. 8 Well, Mr. Faigle, do you find any -- any indication that there is currently available production below the oil/water contact in that well?

A Restate the question, please?

Q My question is when you examine the geologic information for the No. 8 Well and you've identified for us an oil/water contact, can I correctly conclude that you do not see an available opportunity for production of hydrocarbons below the oil water contact in that well?

A The oil/water contact runs right through

the porosity in that well and with the plus or minus factor I talked about, yes, I can seethe possibility of oil produc- tion below -3425 in the No. 8 Well.

Q When we look at your stratigraphic cross section, Number Two, there is no doubt, is there, sir, that the Lambirth No. 8 Well was drilled through the full extent of the Fusselman?

A Yes.

Q And E. P., or Enserch, had the opportunity to perforate all of the potentially productive zones as indicated on that log in that well.

A No.

Q What is the current status of the Lambirth No. 8 Well insofar as the Fusselman is concerned?

A Temporarily abandoned.

Q In what way was that zone abandoned?

A This problem is going to be addressed in the engineering discussion section of this hearing and, if possible, I'd like for you to defer your questions about that to someone more qualified to answer them.

Q With all due respect, Mr. Faigle, I believe it's a geologic question. Let me pursue it with you. I'm obviously not making myself clear.

When we look at the information you have placed on Exhibit Number Two, the information says that cer-

tain of these perforations were squeezed. All right?

A Yes.

Q My question for you is if we have identified an oil/water contact in the well, the production in that well was such that at the time it was squeezed the production rates have fallen and you were making at that point four bar- rels of oil and 100 barrels of water a day. Is that correct?

A No.

Q At the time the perforations were squeezed in the No. 8 Well, what was that well making?

A 10 barrels a day; 10 barrels of oil a day.

Q And how much water a day?

A 200. It was abandoned due to high water disposal costs. It was not abandoned due to lack of production. It was an economic abandonment subject to change.

Q Where is the likely oil/water contact, then, in the No. 8 Well, if we use the stratigraphic cross section to find that point?

A Drilling depth is 7822 plus or minus.

Q Is it your contention, sir, as a geologist that you can come back into this wellbore now with an oil/water contact at that point in this well and go back and open other perforations below the oil/water contact in the

Fusselman and still get commercial hydrocarbons?

A Say that again, please.

Q Yes, sir. I'm trying to understand why this well is not depleted and abandoned in the Fusselman. My question is, if the oil/water contact in that well is at the point you've shown us on the log, can you expect to come in and perforate zones below the oil/water contact in the Fus- selman and achieve commercial hydrocarbon production out of the Fusselman?

A We cannot perforate zones, we will not perforate zones below the oil/water contact. We certainly will consider perforating zones above the oil/water contact.

Q Have you attempted to prepare an isopach of the likely areal extent of any of the Fusselman production for any other Fusselman wells?

A No.

Q Did you take the opportunity to examine any of the transcripts and information presented to the Commission in the case in 1981 that involved the Rader No. 2 Well?

A Yes.

Q Am I correct in remembering, sir, that at that point Enserch proposed to dispose of produced water from the Fusselman and Penn and put that water in the No. 2 Rader Well at a point that was identified as being in the

Montoya?

A That's my understanding of the hearings, yes.

Q You didn't testify at those hearings, did you, sir?

A No.

MR. KELLAHIN: Nothing further, Mr. Lemay.

MR. LEMAY: Additional questions of the witness?

Commissioner Brostuen.

QUESTIONS BY MR. BROSTUEN:

Q I have a couple of questions, I think. In your experience as a petroleum geologist, I'm sure you've had a situation in which you were involved in other carbonate, fractured carbonate shales.

A Yes.

Q Is that correct? What was the effect of water injection into a fractured carbonate reservoir on adjacent wells either for -- I'm not familiar with it insofar as salt water disposal is concerned but, say, we could refer a question from Mr. Kellahin to Ms. Courtright as being in one well pressure maintenance or waterflood, I forget just the exact terminology. Have you ever had experience

in other pool production with that?

A I lost track of the question.

Q I'm sorry. I'll try to repeat that again.

What is -- in your experience what is the effect of water injection into a fractured carbonate reservoir on producing wells?

A It's usually not done simply because the unpredictability of where that water will go; in other words, it's a great risk of that injected water ending up in your producing wells even though they are structurally higher, simply because they're connected with this high permeability conduit from the injection well, from the vicinity of the injection well to the vicinity of the producing well.

MR. LEMAY: Commissioner Humphries.

QUESTIONS BY MR. HUMPHRIES:

Q You made a statement and if I misquote what you said you correct me. This is the way I interpreted it.

When you were talking about the Lambirth No. 8 being temporarily abandoned, you said the economic abandonment -- it had been a temporary economic aban-

donment because of high water disposal costs, not the lack of hydrocarbons.

A That's true.

Q And what's the economic threshold and price where this becomes an economic opportunity?

A I would request you defer your question to the engineer who is prepared to discuss the economics when wells are abandoned and the dollars and cents of the whole operation.

Q But your statement was, then, to the effect that in your opinion the well had been temporarily abandoned because the economics did not justify it.

A Right. We start losing money simply because of operating costs of trucking water.

QUESTIONS BY MR. LEMAY:

Q Mr. Faigle, are you familiar with some of the Devonian production, we'll say further south and east of here in the Tatum Basin?

A Yes.

Q Would you consider that reservoir still within the Fusselman here?

A As far as fracturing goes, yes. As far as the section present, it's -- it's different down there. We have a lot thinner section and a lot more of it missing

up here than we do down in the Tatum Basin, but as far as the Fusselman reservoir itself, they are quite -- they have many similarities.

Q The fracturing is similar in both, --

A Yes.

Q -- as far as you know. Are you familiar with any premature breakthrough due to water injection in any of those fields?

A I cannot point to a specific well which had been prematurely abandoned due to water breakthrough, other than -- other than interpretations of -- of why high, high structural wells water out before lower structural wells. You have to make an assumption as to why this happened and if there's fractures present, you usually assume that the fracture -- the water, the bottom water rose up through the fractures, due to the way the well was being produced; maybe it was being produced at too high a rate, and this is what caused the early watering out, then.

Q Is it possible that coning also could be a factor to --

A Absolutely, coning and fractures go hand in hand.

MR. LEMAY: I have no further questions.

Any additional questions of

the witness?

MR. CARR: No further questions.

MR. LEMAY: He may be excused.

MR. CARR: At this time we would call Mr. Mark Burkett.

MARK A. BURKETT,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q Will you state your full name and place of residence?

A My name is Mark Allen Burkett and I live in Midland, Texas.

Q Mr. Burkett, by whom are you employed and in what capacity?

A I work for Enserch Exploration as a petroleum engineer.

Q Have you previously testified before this Commission?

A No, sir.

Q Would you review your educational back-

ground and then briefly summarize your work experience?

A I have a BS degree from Texas Tech University I acquired in 1984. I have worked for Enserch since that time, approximately five years, the last three of which I've worked in Midland.

Q Does the geolographic area that is within your responsibility for Enserch include that portion of southeastern New Mexico in which is located the South Peterson Fusselman Pool?

A Yes, sir, it does.

Q Are you familiar with the application filed in this case on behalf of Phillips?

A Yes, sir.

Q Have you studied this area and prepared certain exhibits for presentation to the Commission in this hearing?

A Yes, I have.

MR. CARR: We tender Mr. Burkett as an expert witness in petroleum engineering.

MR. LEMAY: His qualifications are acceptable.

Q Mr. Burkett, let's go to the packet of exhibits and I would direct your attention to the base map which is marked Enserch Exploration Exhibit Number Six. and I'd ask you to review the information on that map for the

Commission.

A Exhibit Number Six is the map with the green and red dots on it.

Exhibit Number Six is a base map of the South Peterson Fusselman Field. The scale is one inch equals 1500 feet, so the sections are shown there as one square mile. E. P.'s acreage, or Enserch's acreage is shown as the shaded area. It is again checkerboarded with Phillips' acreage.

Phillips' salt water disposal well, or proposed salt water disposal well, is shown with the red dot. The wells, Enserch wells with remaining Fusselman reserves are shown with the green dots. These are Wells No. 8, 9, 10 and No. 1. Of these wells No. 9, 10 and No. 1 are now producing. No. 8 is not producing but we feel it has recoverable reserves.

In addition to these wells with remaining Fusselman reserves, we also have the reserves in the Lambirth No. 7 Well, which is located down and to the right or in the southeast corner of Section 30.

Q Now on this map would you identify the well that is the subject of the 1981 hearing for a disposal well?

A Okay, this is the Rader No. 2, which is located in the section in the lower right corner of the

map. It is approximately a mile south of the 6-A Well; southeast of the 6-A Well.

Q How does the surface difference between this well and the offsetting then producing wells compare to the distance between today's proposed disposal well and offsetting wells in which you've indicated Fusselman reserves?

A The distances are very similar. In fact, everything seems to be the same as far as distances go and remaining reserves, although reserves are not as significant now as they were in 1981.

Q Let's now go to Exhibit Number Seven and I would ask you to identify that and then review the information contained on that exhibit.

A Enserch Exhibit Number Seven is a reserves summary for Enserch wells in the South Peterson Fusselman field. You can see in the leftmost column Enserch's Wells 1, 3, 6, 7, 8, 9 and 10.

In the column immediately to the right of that we have a cumulative reserve or cumulative production as of October the 1st, 1988, and you can see that those valued add up to over 1.1-million barrels.

Moving immediately to the right of that is the column for remaining reserves. You can see that Enserch has 215,000 barrels remaining in the Lambirth No. 1

Well, which is the discovery well for the field. It has 25,299 barrels in the Lambirth No. 8; 28,521 in the Lambirth No. 9; and 23,984 stock tank barrels in the Lambirth No. 10.

The total of all of these reserves, which are Enserch reserves that we feel are in jeopardy if this disposal well is granted, will be 292,982 stock tank barrels.

Q And are these producable reserves or reserves in place?

A These are producable reserves that are now economic for Enserch to produce.

Q Of the seven wells that are listed, which of the wells are currently producing?

A The Lambirth No. 1, Lambirth No. 9, and Lambirth No. 10 are now producing. The Lambirth No. 8 is not producing at this time.

Q Before we go on, tell the Commission, who is E. P. Operating?

A E. P. Operating owns all of the wells. I work for Enserch Exploration. All of us work for Enserch Exploration. Enserch Exploration is the managing general partner of E. P. Operating, which is Enserch Partners, as I occasionally use the terms synonymously but E. P. owns the wells. We work for Enserch.

Q Okay. Now, let's go back to this exhibit and explain to the Commission how you obtained the remaining reserve figures that are depicted on Exhibit Number Seven?

A These remaining reserves estimates were made by projecting the current or past production performance into the future, and I have exhibits to show how this was done.

Q And have you decline curves on each of these wells?

A Yes, sir, I have.

Q And is that what has been identified in this packet of exhibits as Enserch Eight-A through Eight-E?

A Yes, sir, that is correct.

Q All right, let's go to Exhibit Eight-A and I'd ask you first to identify that.

A Exhibit Eight-A, in fact, all of the exhibits have on the X scale years and on the Y scale it's a logarithmic scale going from 10 barrels of oil per month to 100,000 barrels of oil per month.

Exhibit Eight-A is the Lambirth No. 1 Well, which is the discovery well for the field. It was drilled in 1978 and has been producing very prolificly. It has produced an allowable from 1978 to 1985, thus indicating that there's aquifer support. We've had very little

decline. Something has supported this well during this period of time. We produced no water until 1985. The well began on a decline and this decline was extrapolated from October, 1988, into the future and highlighted in yellow there is 215,178 stock tank barrels of oil remaining.

This exhibit will be discussed a little further later on.

Q All right, let's now go to the information on the Lambirth No. 7 and that's Exhibit Eight-B, and I'd ask you quickly just to review what this shows.

A This is the Lambirth No. 7 Well. You can see the oil production. I forgot to mention earlier, the water is shown as the triangles; the oil production is in the dark circles.

You can see that both the water and oil production declined very rapidly, got below 100 barrels of oil per month. The well was abandoned. It's not producing in the Penn, marginally economic in the Penn.

Q And have -- the reserves being assigned to this well are zero.

A I have assigned zero reserves to it; however, commingled (unclear) may be obtained. We may be able to extend this out some.

Q All right, now let's go to Exhibit Eight-C. This is the Lambirth No. 8 and I'd ask you to re-

view what this shows.

A Okay. The Lambirth 8 is a direct offset to the Lambirth 6-A Well. It began producing in 1979 and began to make significant amounts of water very quick. The well exhibited a normal decline until early in 1984 and you can see that the production fell off very drastically and we discovered that we had tubing leak that was largely responsible for this.

We repaired the leak and we had a bad tubing string and continued to have problems with it. We were tempted to produce it in '85; then again, in 1986 these -- these problems were corrected.

We produced the well during three months in 1986. This was from May 16th to July 17th, so two of those months were only half month periods, and showed the -- showed very little production relative to the month of June, which is one full month of production, and during that month the well made 289 stock tank barrels of oil.

The well was abandoned at this time because we were having to truck water to our salt water disposal facility. We were being charged 67 cents a barrel and 40 percent, 40 cents at the disposal, so the net cost was $1.07 per barrel which prohibited producing this well economically.

The well was temporarily abandoned by

cement squeezing the well. We knew in the future to come back to it we would have to cement squeeze the Penn, and doing so it would be very easy to drill out both zones and we have continued to produce Penn reserves and they are just now becoming marginally economic, and this well has just recently been recommended to our management to re-enter into the Fusselman.

Q And the remaining reserves that you predict for the well are?

A 25,299 stock tank barrels of oil.

Q So based on the way the well produced when you were able to produce it during 1986, do you have an opinion as to whether or not you have lost reserves in this well?

A From the period of 1984 to 1986, the productive capacity of the well did not decrease any at all so that indicates to me that there was no -- no elevation of the water/oil contact during that period. We did not lose our ability to produce oil over that time period when a well was shut in.

Q At the time you abandoned the well you testified that your disposal costs were $1.07 a barrel. What disposal costs do you anticipate for disposing of water from this well at this time?

A We anticipate 40 cents per barrel

because since the time the well was abandoned we've installed a salt water transportation system to our salt water disposal system which is located about 10 miles north of here.

Q At the time the well was abandoned what volumes of water were being produced?

A We were producing approximately 200 barrels of oil per day which --

Q 200 barrels of oil per day?

A Of water per day, 200 barrels of water per day and 10 barrels of oil per day.

Q Do you anticipate producing volumes of water similar to that in the future?

A We anticipate that by perforating higher in the section, since we cement squeezed it in the past, and that was part of the justification for cement squeezing it, that we could perforate higher in the section, by perforating higher in the section and then by doing a polymer treatment, that we should be able to reduce this to less than 100 barrels per day; hopefully, less.

Q And if you are able to accomplish that, in your opinion will the Lambirth 8 have economic reserves that can be produced?

A It will have economic reserves.

Q And do you concur with Ms. Courtright's

conclusion this morning that this well has in fact watered out?

A No, I do not.

Q Now let's go to Exhibit Eight-D and I'd ask you to explain that, please.

A Exhibit Number 8-D is a Lambirth No. 9 Well. This well shows a hyperbolic decline. I've extrapolated this performance out to an economic limit of 100 barrels of oil per month. You can see it has very little water production and based on this projection, as shown, the well should ultimately -- should have remaining reserves of 28,521 stock tank barrels of oil.

Q Mr. Burkett, will you now go to Exhibit Eight-E, the Lambirth No. 10 Well?

A The Lambirth No. 10 exhibits very normal decline; it's producing at a very -- or a large amount of water. By now it's making approximately 300 barrels of water per day and 15 barrels of oil per day. Based on this decline it has remaining reserves of 23,984 stock tank barrels.

Q Mr. Burkett, is it your testimony that Phillips' application puts at risk the reserves that you have identified on each of these decline curves?

A Yes, sir, that's correct.

Q I believe you testified that at present

the Lambirth No. 1 and 9 and 10 were currently economic wells producing from the Fusselman?

A Yes, sir, that's correct.

Q That in addition to that you've listed the No. 8 Well that can be returned to economic (unclear).

A Yes, sir, that's correct.

Q But the No. 8 is -- from an economic point of view, would be the poorest of the four, is that correct?

A It's the poorest of the four.

Q All right, let's go to Exhibit Number Nine, economic calculations on the No. 8 Well, and I'd ask you to review what is depicted on this exhibit for the Commission.

A These are economic calculations performed in a manner similar that Enserch would use to justify doing any work to this well. It shows that Enserch has 25,000 barrels of oil remaining and that these reserves are economic.

Q All right, let's go through this exhibit column by column. The first column says Year. Number 1 indicates the first year the well would be back on production, is that correct?

A That is correct.

Q What is the source of the figures in the

column entitled Annual Oil Production?

A These values came from Exhibit Eight-C, where the extrapolations were shown. These values were pulled from there and placed in this (unclear).

Q Now, if we go to the next column, Oil Price, in dollars per standard barrel of oil, what is the source of those calculations?

A Our internal evaluations at the time this was prepared was we were using $16.00 per barrel, escalated at 5 percent.

Q And these are the figures that are used internally by Enserch in evaluating prospects?

A Yes, sir, that is correct. I now feel that these were conservative since we are now using $17.25 a barrel, which is the current posted oil price.

Q All right, now let's skip over the next column and to the column that says Gas Price, are these again internal price projections?

A These are internal price projections starting at $1.30, escalating at 10 percent a year, which again is internal values. I feel that these are conservative, as well. We are now using $1.45.

Q All right, and the column between those is an Annual Gas Production. What gas/oil ratio are you using?

A I'm using a constant gas/oil ratio of 600 standard cubic feet per stock tank barrel.

Q All right, and then the next several columns are just drawn from the data previously, the Gross Revenue, the Net Revenue, and you have reduced operating -- by operating expenses?

A Yes, sir. They -- these come from our internal operating statistics we have. Now $8500 per year, I've escalated that 5 percent to meet inflation.

Q What are the -- what is the basis for the Production Taxes that you have shown on this exhibit?

A I used -- I again got those from our internal operating statistics which are 8.7 percent of the gross revenue.

Q The next thing you have is Water Production in barrels. What is the -- are you basing those figures on?

A That's correct. I assumed a total fluid production of 100 barrels of oil per day and subtracted the expected oil production to estimate these values.

Q And then the Water Disposal dollar amount, the cost of disposal, what was that based on?

A Based on 40 cents per barrel.

Q And then the last column gives you a Cash Flow, is that correct?

A Yes, sir, that is correct.

Q What conclusions can you draw from your Exhibit Number Nine?

A Okay. From Enserch's point of view, these 25,000 stock tank barrels of oil remaining are economic.

Q And you have recommended to your management, did you say, that you go back and try to return this to production?

A Yes, sir, we have.

Q When was that recommendation made?

A I believe it was made March the 1st. I acquired -- I was assigned to the deal November the 1st and at that point I looked at the Lambirth 8 and it -- to me it looked like a good candidate to go back to but we had this hearing going on and I have been busy preparing for the hearing and have not been able to make a recommendation, but due to its postponement, I have been able to get that recommendation out.

Prior to this the Lambirth 8 has always been in the back of everyone's mind but we have not had the salt water disposal well available to us, and also, we were producing from the Penn. The Penn reserves were still economic and there was no need in abandoning these Penn reserves, so it was decided to forgo plugging off the Penn

and trying to get it later because it would not be economic and to go ahead and abandon or take the Penn to economic limit before returning to the Lambirth No. 8.

Q Is it your opinion that there are commercial reserves available to be produced by Enserch in the Lambirth No. 8?

A Yes, I believe there are.

Q Let's go to Exhibit Number Ten. This is similar to Exhibit Eight-A, and I would ask you to identify for the Commission how this exhibit differs from the prior exhibit.

A The main difference is the -- is the annotation of the choke sizes. You can see that in 1978 the well was flowing with a 12/64ths inch choke. It continued producing until the middle of 1985, water free, flowing at allowable on this choke size.

In 1985 we had a significant increase in water production; jumped to 20 barrels of water per day. The oil production also began to drop. We choked it back to an 11/64ths inch choke. We did see some positive signs but they didn't last very long. You can see that in the late part of '86 we were starting to see an increase in water production in the unit. At that time we choked it back to a 10/64ths inch choke. The water production has continued to drop off and right now we're producing water-

free.

The oil production is now down to about 67 barrels a day but what this is showing is that we have a very delicate balance. We're trying to optimize the recovery from this well and in doing so we have this very delicate balance that could be disrupted if there was some outside influence that affected this.

Q Does this information suggest some support for this well from the reservoir water drive?

A Pardon me?

Q Does this, the information on this exhibit support or suggest water drive support, or reservoir support for this well?

A Yes, it certainly does. We saw no decline over the period from '78 to 1985; virtually no decline and the gas/oil ratio was fairly constant. It appears that it is being very actively supported by the aquifer and then the water breakthrough in late 1985 also suggests that we have pressure support from the aquifer and right now we're able to quell some of the effects from that, but we feel that but we feel that any disruption could -- could upset this and we could lose the reserves, which are very significant to Enserch, 215,000 barrels; very significant reserves.

Q Does this information suggest that this

well is in communication with the rest of the reservoir as opposed to being a separate reservoir?

A Certainly.

Q In your opinion would injection as proposed by Phillips put this well in serious risk?

A Definitely.

Q How far from the proposed injection well is the Lambirth No. 1 actually located?

A It's approximately one mile away.

Q And how soon would you anticipate that you might experience water problems if in fact injection in the proposed well is permitted?

A It would impossible to quantify because we don't know the orientation of the fractures, the percent of porosity the fractures have, and the amounts that are being injected, but I could say it can happen fairly soon; we could water out almost immediately and lose these reserves and not be able to recover the hydrocarbon.

Q Are you aware of any way to monitor this so that you could determine in advance whether or not there was a water breakthrough about to occur in this well?

A I feel that once breakthrough occurs we will lose these reserves or a significant portion of these reserves and it will not be recoverable.

Q I'd like to direct your attention now to

-- for a few minutes, to the existing disposal facilities for water from this reservoir. I believe you testified that when you abandoned the No. 8 the disposal cost was $1.07 a barrel.

A Yes, sir, that's correct.

Q At that time was there a disposal well available to you?

A There was a disposal well available to it. It is our well, the Scott Federal No. 2, which is located about 10 miles to the north. We drilled -- initially we were being charged $1.67 a barrel to dispose of the water by the time we had it transported and disposed.

We drilled this well at a cost of approximately $900,000, set pipe to the Fusselman and we were trucking water from the South Peterson Field to that disposal well.

Q And that's when you had the $1.07 --

A $1.07, which is 67 cents for trucking and 40 cents to dispose into it.

Q What have you done that now enables you to dispose of water at a 40 cent price?

A We installed a transportation system or a transportation line, from the South Peterson Field to the Scott Federal No. 2 Well, which is approximately 10 miles away, that takes our water, has a central tank battery,

takes our water, and transmits it down the line to the disposal well.

Q And is this a commercial disposal well?

A Yes, sir, and it is -- we have several operators in the area; in fact, it's the only disposal well in the area. We have BHP, Gandy, Petrus, Phillips and Enserch, all dispose of water into this salt water disposal well.

Q Now, Mr. Burkett, you were present today when the question was presented to a Phillips witness as to whether or not they had proposed disposal of water at, say, 10 cents a barrel, in their well. The response was that Phillips had -- that Enserch had declined. Were you involved in that decision?

A Yes, indirectly. The reason that we declined that decision is primarily because of fear of losing our reserves in the South Peterson Field, but also we have this system already available that we have had a huge capital outlay to install this system; the transportation system was $140,000, and we had the $900,000 expenditure to put the well in.

Q Okay, let's go to what has been marked as Enserch Exhibit Number 11. This consists of -- I believe there's a clip on it in your book -- it consists of an agreement and two letters on top of that, and I'd like

to jump a little out of order because I put them in the wrong order, and go to the letter, the second letter, and it's dated July 11, 1984, and I'd ask you to identify that and explain what that is, Mr. Burkett.

A Okay, this is a letter from Mr. Leonard Kersh, who is the District Production Manager in the West Texas District, to Phillips Petroleum Company. Attached to this letter was an informal cost estimate for the transportation line from the South Peterson No. 2, Enserch's disposal well, giving them the opportunity to participate in that disposal line. The date of this letter is July, 1984, and Enserch went approximately one year without ever having any response from Phillips.

Q What is the first letter in this Exhibit Number Eleven?

A You can notice the first letter dated July 23rd, 1985, one year later. It is again from Mr. Kersh to Phillips Petroleum Company. He is simply stating that since we have not received any response from them, that we considered the operating agreement null and void.

Q And what happened at that time? Did Phillips --

A At that time --

Q Did Enserch go forward with the well?

A Enserch went ahead and laid the line,

again at a cost of $140,000, and shortly afterwards Phillips approached Enserch about reducing their water disposal fee, which at that time was 40 cents per barrel.

Q All right, would you now refer to, as you go forward with this testimony, what has been marked Exhibit Twelve-A and Twelve-B, and what is Exhibit Twelve-A?

A Exhibit Twelve-A is an operating agreement between Enserch and Phillips. It is dated October the 6th, 1982, and what it shows on the second page of this exhibit is that Enserch is charging Phillips 40 cents per barrel to dispose into their salt water disposal well, which we feel is a reasonable and customary charge.

Q Is this what other operators are paying?

A Yes, sir, that is correct.

Q All right, now let's go to Exhibit Twelve-B and I'd ask you to just identify that.

A Again this is a salt water disposal agreement between Enserch and Phillips; however, the date now is August the 6th, 1987, and as you can see on page 3, highlighted in yellow and underlined in red, at Phillips' request Enserch reduced the disposal cost from 40 cents to 30 cents per barrel and is now charging them 10 cents to dispose of water into the line; therefore Enserch has accepted the burden of paying the landowner the 10 cents per

barrel that they are currently paying them to dispose of water.

Q Are any of the other operators who dispose into the well getting this 10 cent per barrel benefit?

A No, sir, they are not.

Q So the total cost to Phillips is 40 cents for the disposal.

A Per barrel.

Q And that is 10 cents less than other operators are charged.

A Yes, sir.

Q And is that 40 cents the basis for the 40 cents that you've used in your economic calculation on the Lambirth No. 8?

A Yes, sir, I assumed that we would charge the same to our partners.

Q Is that the available price that anyone is charged for the disposal in that well?

A Yes, sir, that's correct.

Q During the past few months while this matter has been pending, has there been any contact with Phillips concerning any further use or price adjustment for disposal in your existing disposal well?

A Other than the 30 percent decrease I'm not aware of any.

Q Anything since that time?

A I believe Phillips offered us the opportunity to dispose into their well at 15 cents per barrel, but other than that I'm not aware of anything else.

Q Have there been any inquiries about adjusting the cost of using the Enserch Well, that you're aware of?

A No, sir, not that I'm aware of.

Q Based on your study of this area, Mr. Burkett, are you prepared to make a recommendation to this Commission as to what should be done with Phillips' application?

A Yes, sir. I think it should be denied.

Q And why is that?

A Because a significant risk will be added to all of Enserch's reserves. These wells could be watered out very soon and therefore Enserch' recoverable reserves could be reduced or (unclear).

Q In your opinion if this application is granted would the correlative rights of Enserch be impaired?

A Yes, sir. Enserch would not be able to recover its share of the reserves under its tracts.

Q In your opinion if the application is granted could that result in the waste of oil?

A Certainly could. These wells could be watered out very soon and Enserch would be denied the opportunity to go back and get those reserves.

Q Were Exhibits Six, Seven, Eight-A through Eight-E, Nine, Ten, Eleven, Twelve-A, and Twelve-B either prepared by you or compiled under your direction?

A Yes, sir, they were.

Q Can you testify as to the accuracy of these exhibits?

A Yes, sir, I can.

MR. CARR: At this time I would move the admission of Enserch Exhibits Six, Seven, Eight-A through E, Nine, Ten, Eleven, Twelve-A and Twelve-B.

MR. LEMAY: Without objection all those exhibits will be admitted into evidence.

MR. CARR: That concludes my direct examination.

MR. LEMAY: Mr. Kellahin.

MR. KELLAHIN: Thank you, Mr. Chairman.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Burkett, I missed some dates and

some sequence of events in your direct testimony. If you'll help me with some of the information, the current method of disposal for Enserch to take the Fusselman produced water, is to take it off the area shown on our Exhibit Number Four, some several miles to the north?

A Yes, sir, that's correct.

Q And that's identified as the Scott Federal No. 2 disposal well?

A Yes, sir.

Q I'm not sure I heard you tell me at what date that disposal system was ready to accept its first barrel of produced water out of the Fusselman.

A I'm not sure. It was around '82 or '83, 1982 or 1983.

My guess is August 6th, 1982. That's the date --

Q Your best recollection.

A Yes.

Q Sometime in '82.

A Yes, somewhere in there. Yes, sir.

Q At that point then what were the costs to Enserch for disposing of a barrel of produced water out of the Fusselman?

A Prior to the disposal well?

Q No, sir, at the time you got it all

(unclear) --

A Okay.

Q -- in the summer of '82 and you're ready to move water from South Peterson up to the disposal well, what were you using for cost per barrel?

A We were using $1.07 per barrel, which consisted of 67 cents for transportation and 40 percent to Enserch to cover operating and maintenance expenses and recoup our initial investment.

Q Was that the price you were charging others or were others not available for participation in that system at that time?

A Everyone was being charged that price.

Q From the summer of '82, then, the cost for disposal is, what did you say, $1.07?

A Yes, sir.

Q Okay. How long did that continue to be the cost of disposal?

A Till May of 1987. May 1st.

Q May 1st of '87, then, what happened at that point?

A At that point Enserch installed the transportation line from the South Peterson Field to their Scott Federal No. 2 Well.

Q And the costs, then, were reduced for

Enserch and the others participating in the system, at that point went down to 40 cents.

A Yes, sir.

Q When I look at Exhibit Number Twelve-A, this is an agreement with Phillips dated October 6th of '82, and on the second page at the bottom highlighted in yellow, it says Phillips agrees to pay 40 cents a barrel.

A Yes, sir, that's correct.

Q Well, I'm confused. This is '82. You're charging them 40 cents a barrel but you just told me it's $1.07. Is there another cost factor in the agreement?

A Yes. Like I stated before, 67 percent was for transportation to haul the water, Enserch's water, from the South Peterson Field to the Scott Federal No. 2 Well.

Q All right, part of this agreement, somewhere in it has that cost.

A No, sir. This is done by an outside vendor.

Q Oh, I see, so Phillips pays that themselves.

A Phillips was hauling their own water, is my understanding.

Q I'm with you now.

A Okay.

Q So by May of '87, then, we've got the transportation system, the pipeline, if you will, to take the produced disposal water and eliminate the trucking charge.

A Enserch does, yes.

Q Yeah, and we can move that on out to the Scott well.

A Yes, sir, that's correct.

Q When we look at the remaining reserves for the No. 8 Well, okay?

A Yes, sir.

Q I get that on Exhibit Eight-C, there's your decline curve on -- on the No. 8 Well?

A Yes, sir.

Q What was that well producing at the time the Fusselman was abandoned and the well was recompleted in the Pennsylvanian?

A 10 barrels of oil per day and 200 water.

Q And that was determined to be uneconomic for continuation of the Fusselman production.

A At a -- at disposing water at $1.07 per barrel, yes, sir, it was under that oil price at that time, which I believe was very low then.

Q What was the date that you squeezed off the perfs in the Lower Fusselman No. 8 Well and moved on up

into the -- up into the --

A I'm not -- I'm not sure of the exact date.

Q Would that have been about April of 1987?

A That's possible. I know it's after June or July of '86. I'm not sure of the specific date.

Q You don't have any information to explain --

A I do not know if --

Q Let me ask the question and see if you can explain it for me.

In my looking up to this exhibit, and maybe I'm wrong, but you told me that in May of '87 the costs now are going down to 40 cents --

A Yes, sir.

Q -- and yet you plug off the perfs in the Fusselman in the No. 8 and abandon it.

A Yes, sir. We have to remember that we were in the Penn by that point, or we had economic Penn reserves, so we went up to the Penn. At this point, June, 1986, the well was producing from the Fusselman uneconomically. We had the choice of plugging the well, leaving it temporarily abandoned until we got the salt water disposal line in or the system in, or we could go ahead and get the

Penn reserve which we knew existed, and we opted to go ahead and get the Penn reserves and then come back to the Fusselman at a later date once the salt water disposal system was installed.

Q Am I correct in understanding that the salt water disposal system including the pipeline to move that produced water was in place in May of '87?

A Yes, sir. May 1st, 1987.

Q And approximately that very same time you were reducing your salt water disposal costs for that well, you elect to abandon it.

A I'm not sure when we abandoned it. I know it was after '86. We abandoned the well, we quite producing the well in June of '86, one year before the salt water disposal line was in place.

Q When we look at your various economic projections, they are conditioned in each instance for each of these wells on your decline curve that you've shown starting with Exhibit Eight, Eight-A?

A Yes, sir, Eight-A?

Q Yes, sir.

A Okay.

Q That's an example of a decline curve that forms the basis upon which you calculated the remaining reserves for the well, applied some economics to it,

and told us what -- what you got left.

A Yes, sir.

Q All right. When I look at the No. 1 Well, how far have you run out that decline curve before you have reached an economic limit?

A I ran it to an economic limit of 100 barrels per month.

Q 100 barrels of oil?

A Oil per month.

Q Does the water production rate factor into the calculation?

A It certainly would.

Q And for this well can you show me what the water rate is?

A Right now it's zero.

Q No, sir, I meant in order to reach your economic limit?

A I have no idea.

Q No way to handle that?

A Right. Right.

Q Did you use the same economic limit on all of the decline curves for each of the wells?

A Yes, sir, I did.

Q And that was 3 barrels of oil a day.

A Roughly, a little more.

Q You have summarized for us on the Lambirth No. 8 Well, using Exhibit Number Seven, that you believe in the Fusselman you have some 25,000 barrels of remaining producable oil reserves.

Did I find that in the right place?

A For the Lambirth No. 8?

Q Yes, sir.

A Yes, that's correct.

Q Okay, are these your calculations?

A Yes, sir, they are.

Q You've told us that you, in the No. 8 Well, that you believed you could come back in and get the rest of the Fusselman reserves in that well at some later time?

A Very soon, yes, sir. In fact we recommended it to our management.

Q Let me show you Mr. Faigle's stratigrahic cross section that includes as the second well over from the righthand side, the log of the Lambirth No. 8 Well. Show me where you're going to put the perforations in that well, stay in the Fusselman when you get the rest of the oil reserves.

Do you have a copy of it?

Q Yes, sir, I do have a copy. I'm not sure of the specific reserves that we recommended to our

management, but to the best of my recollection some were in the vicinity of 7888 to possibly 7898 feet, and we were -- which puts it in the Upper Fusselman, and we are not convinced that the Upper Fusselman and Lower Fusselman are in communication here, and rather than shooting down in the Fusselman, we wanted to -- down in the Lower Fusselman, we wanted to first try shooting in the Upper Fusselman to maximize our oil column and minimize the water drive.

Q Have you made a study to examine where the oil/water contact is in the Lambirth No. 8 Well?

A No, sir, I have not. It does appear that it's not moving out of range, based on the response, the production response that we see.

Q In addition to some of the wells in the half mile radius that Ms. Courtright discussed, we've just talked about the 7 and the 8. You've identified for us the well that you have concern about and that's the Lambirth No. 1 Well and that's the discovery well?

A Yes, sir, that's correct.

Q And that's an approximate distance of about a mile from the proposed disposal well?

A Yes, sir, that's correct.

Q What is the current producing rate on the Phillips No. 2 Well in -- just to the north of your No. 1 Well and between the disposal well and your No. 1 Well?

A The Lambirth No. A-2, A No. 2? Now making about 50 barrels of water per day and about 300 -- I'm sorry, 50 barrels of oil per day and 300 water.

Q That well is still economic under your criteria, is it not?

A Yes, sir.

Q Have you calculated to determine the length of time it will take for water disposed of in the disposal well to migrate towards the No. 1 Well?

A If I knew the orientation of the fractures I would be able to do that. I felt that radial flow calculations did not apply in this case and therefore I did not make those calculations.

Q Would you be a correct statement that the first well at risk, if there is to be water encroachment in a southerly direction, is going to be one of the Phillips' producing Fusselman wells before it gets to your well?

A That is possible. They have things to gain that we do not.

Q What was the original total cost you gave me about the cost of the disposal lines up into the Scott well? I think it was $190,000.

A $140,000.

Q $140,000.

A Yes, sir.

Q Have you recovered those costs yet out of the disposal operations?

A I'm not sure.

Q One of the items at risk for your company is loss of that income that Phillips pays your company for a disposal fee, is that not true?

A Yes, sir, revenue.

Q Excuse me a minute.

Mr. Burkett, if you'd turn for me to Exhibit Number Eight-C, which is your decline curve on the Lambirth well.

A Okay.

Q The dark line, the heavy black line that picks up in '86 and then goes in a declining method to 1982, that represents what, sir?

A That's the anticipated future production and future decline for this well.

Q When you construct a decline curve on that future production basis, you pick points off of past actual production points on the curve, is that correct?

A Yes, sir, that's correct.

Q When we go back and if -- if we were to continue your curve and complete that arc, the notion would be that you would go back and intersect as many data points

on the curve as you could so that you'd have a nice uniform decline --

A Yes.

Q -- that honors as many data points as possible.

A That's correct.

Q When we look at your data points from late -- well, early '84, start with the beginning of '84 and move through '85, there are some data points on the curve, are there not?

A Yes, sir, that is correct.

Q It appears to me, sir, that you have ignored those data points in putting your decline curve of future production on the display so that your future reserves are inflated.

A That is correct. I did ignore those, because at that point we were having tubing leaks in the well. Although we didn't discover it immediately, at a later time we did discover that there were tubing leaks and it was causing the production to be less than it could have been.

Q At what point did you discover the leak?

A I'm not sure as to the specific date, but I would say somewhere in late 1984.

Q Has Enserch corrected the tubing leaks

in the No. 8 Well?

A Yes, sir, we have.

Q And what production would represent points attributable to information after the tubing leak had been repaired?

A The point June, 1986, which is 289 stock tank barrels of oil, which is the point immediately before the projection.

Q And that's the last point we have on that --

A Production, yes, sir. That's one full month of production.

MR. KELLAHIN: Thank you.

MR. LEMAY: Thank you, Mr. Kellahin.

Additional questions of the witness?

I've got a few, Mr. Burkett.

QUESTIONS BY MR. LEMAY:

Q I'm trying to recall, Enserch, is that the old Clinton?

A Pardon me?

Q I'm trying to trace your history.

A We were originally Lone Star Producing

Company.

Q You were Lone Star, okay.

A Yes, sir, in 1975 we were renamed the Enserch Exploration and I believe it was around '85 or '86 when we formed a master limited partnership, E. P. Operating, and we've continued to operate under -- or not operate, we're employed by Enserch Exploration because of the partnership and the things involved there, the wells are operated by E. P. Operating and owned, or the title is held, by E. P. Operating.

Some of that is stock -- is public, E. P. Operating. I believe Enserch Exploration at one time owned around 87 percent. Enserch Exploration is a managing general partner of E. P. Operating. They owned about 87 percent of E. P. Operating and the public owned the remaining 13 percent or so.

Q I see, but you don't have any limited partners, or they are limited partners?

A We do have limited partners. They are public.

Q Through a stock offering?

A Yes, sir.

Q But they did not participate in the initial wells. It was the same --

A Well, the wells drilled since that part-

nership was formed, these partners were in on the drilling wells.

Q I guess what I'm trying to get around to, is the ownership in the wells in the South Peterson Fusselman Field the same as the ownership of the disposal well ten miles north?

A Yes, sir, they are. It is the same. It's all owned by E. P. Operating, which would be mostly Enserch Exploration and the 13 percent, or so, public, publicly held.

Q Is that also the same $140,000 for the cost of a line was paid by E. P. Operating?

A E. P. Operating, yes, sir.

Q And the ownership tract's the same all the way through production.

A Yes, sir.

Q So you're in essence charging yourself --

A Yes, sir.

Q -- as well as other folks the standard fee of -- your testimony --

A Yeah.

Q -- said something like you had to pay 40 cents per barrel. I didn't know you're paying yourself 40 cents per barrel or was some other company involved.

A We have partners in most of the well. I

think we own 50 percent working interest in most of the well, so therefore, for internal accounting we have to charge ourselves to effectively charge the partners and that charge is, you know, salt water disposal system stands alone. It accrues operating and maintenance expenses and then it's being paid this 40 cents per barrel by us, but the ownership is the same, except that we own 50 percent of some of the wells and our partners own 50 percent, you know, they own their share of the wells also.

Q Have you worked any economics on extension of reserves or extension of well life, additional reserves by allowing disposal at 15 cents a barrel or you have those capitalized costs, I understand, of 900,000 disposal line, but if you were separate companies could you extend the line of the property by paying 15 -- a total of 15 cents a barrel rather than maybe the 40 cents?

A We probably could. The problem we get into, we have to pay the surface owner 10.77 cents for every barrel that we dispose into his property because the production is not made on his property. It's my understanding that most operating agreements, if you produce the water on the lease, you can dispose it in the same lease free, but if you produce it on another lease, you normally pay the surface owner, and I think 10 cents is a good -- pretty common rate or my experience has indicated it's a

pretty common rate --

Q So --

A -- and right now -- I'm sorry.

Q I'm sorry, I didn't mean to interrupt you.

A Right now we're paying 10.77 cents per barrel, and then we have operating costs. We have leaks, you know, we have line leaks that we have to cover and pay damages on those line leaks. We've had that problem. We have to stimulate the well pretty often and last night I was doing some rough calculations and it appears to me that we may be reaching pay out, we should be getting pretty close to pay out on the disposal well and disposal system.

Q Well, then, by -- let's make some assumptions, if you did take Phillips up on their offer of 15 cents, you would have less lines, less distance, so you'd minimize that aspect of it. It's just environmental damage is possible.

A Well, that's true but we've already got the line laid so I would assume that we would continue down that line.

MR. LEMAY: Commissioner Humphries? That's all I have. Thank you, very much.

A Okay.

QUESTIONS BY MR. HUMPHRIES:

Q Mr. Burkett, you may have answered this question and I apologize if I was out of the room, if you did, tell me, and I'll be brief. You have indications on your future recoverable -- additional recoverable reserves on Exhibit Seven, of some percentages that look to me like they're going to be about 20-to-1 on the No. 9 and 18-to-1 on the No. 8. Prior testimony, not by yourself, indicated that about 10-to-1 starts to be a questionable proposition.

Why do you feel comfort in such high percentages?

A Well, those, the testimony earlier was for Phillips. Hopefully, Enserch can do -- can operate more economically. The wells, you know, I've made projections based on a method that Enserch uses internally to evaluate its expenditures and that may be different from how Phillips does it or how someone else might do it, and I'm sure it's different.

Q Okay, you've answered my question. On your calculation of rates of return on those economics that you projected on Exhibit Number Nine, if you look at on the Number 8, which is the one that you tend to be more concerned about, something on the order, and I don't have a calculator, but I suspect my math is pretty close, about a 22 percent rate of net return on gross revenue, did you do any

net present value calculations or are you just --

A Yes, sir, I did, and the -- our evaluation programs, I assume we keep them proprietary, so I didn't -- I didn't use those here. I think a lot of times it hurts our competitiveness if we're bidding for something, bidding for a property or something like that, but I believe that's kept proprietary and that's why I didn't include it here.

Instead I tried to come up with something that was general and that could be easily understood with everything shown here but with the escalations that Enserch uses, which I feel are pretty common, to 5 percent for oil and 2 percent for gas, and the reason I'm mainly -- that I've shown the Lambirth 8 calculations is because it's the only well that's not producing now and I could foresee a question about its producability in the future.

Q Okay, when is year one? When did you prepare this exhibit?

A Year one would be if we started -- if we started tomorrow it would be -- year one would be from March the 10th to --

Q Approximately calendar year 1989?

A Yes, sir, would be one year.

Q And then you've talked about 12-year return on that. What are you talking in 12-year in your

prices?

A Well, that's a good question. Really, you know, these are what's done internally. I guess no one knows for sure. That's what we're doing internally to make decisions about current investments and I think that's what this exhibit shows, is that to Enserch to make a decision today about what's going to happen in the future, this is economic and therefore that was the basis for us recommending it to our management.

Q And a part of Mr. Kellahin's cross (not clearly audible) but do you know, does Enserch pay Phillips any override to the royalties or some -- since you got this on a farmout from Phillips, I suspect there are going to be some kinds of agreements.

A I'm sure there are some royalties, overriding royalties, but I'm not -- I'm not familiar with that those would be. There may not be since it's a checkerboard. It may be, you know, they have an offsetting acreage, that would -- that would be the up side for them, and which it turned out very lucrative in this case for them. We -- we had the expense to test the prospect for them. We drilled the Lambirth No. 1. It was successful and that set up several wells for them, three of which -- four of which are currently producing that are very good wells. They've made Phillips a lot of money, but I'm not

sure about the overrides, what would be involved there.

Q Okay, so your answer is you think so but you're not sure.

A Yes, sir. I do know that the total overriding royalty is -- not total overriding, it would be the total royalty is 12-1/2 percent; it sounds very low to me and it sounds like there's probably not an overriding royalty. I think 12-1/2 percent, that's -- that's about the leanest I've ever seen, as far as royalties go.

Q One other quick question, two other questions.

I think I must have misunderstood. Did you say that initially in 1982 you were estimating your disposal costs at $1.70 or $1.07?

A $1.67 in 1980 -- I'm sorry, yeah, that's correct. In 19 -- when we first started, in fact, in 1978 we were being charged or it was costing us $1.67 per barrel to dispose of water and that's having it trucked to some disposal facility, which apparently was some distance away. I'm not sure how far away that was.

Q Okay, so the 67 and the 40 are not necessarily consistent components of the $1.67.

A I don't believe so.

Q 40 cents is your calculated cost at your disposal well.

A Okay, now that was after the well was -- after we had our -- our -- or we put in our disposal well to the north in 1982. We were charging ourselves 40 cents per barrel and it was costing us 67 cents per barrel to have the water trucked from the Lambirth No. 8 Well 10 miles to the north to the Scott Federal No. --

Q I got that. I understand the $1.07.

A Okay.

Q There was another figure that you advanced --

A Okay.

Q -- that I thought was $1.70 or $1.67.

A Yes, sir, it was $1.67 prior to us having our own salt water disposal system; system, I mean well, located north. Prior to that we had to go to some distance away.

Q All right, so that's -- I was trying to -- one of my earlier questions you may have answered by implication, but I asked Mr. Faigle if it was an economic threshold that you saw in reactivating the No. 8 and he was unable to give me that number. Now I received part of an answer by implication there, but I guess my direct question to you is the economic threshold could be attained by prices of commodity or the economic threshold is going to be obtained by lowered cost of operations?

A It would be a function of both, although it seems that the price of oil has a much more driving effect than does operating expenses, but it will be a combination of both. Reduction of operating expenses will extend that economic life or reduce it from, say, 3-1/3 barrels of oil per day to let's say 2 barrels of oil per day. Right now with the Lambirth No. 7 that was mentioned before as not being economic, it is marginally economic to us at about 2 barrels of oil per day, very marginal but we can do that. Other wells in this projection I made here it ends up 3.7 barrels a day. So it's going to be a function of how much water is disposed, the electrical cost of lifting the water, and our operating costs. And oil price.

Q Should I tell the economists and revenue projectors who forecast for the Land Office to use these numbers?

A Certainly.

Q Thank you.

MR. LEMAY: Additional questions of the witness?

Yes, Mr. Kellahin.

RECROSS EXAMINATION

BY MR. KELLAHIN:

Q I apologize, Mr. Burkett, I forgot to

ask you awhile ago. I'd like to focus on the No. 8 Well.

A Okay.

Q I want to understand the Penn production out of the No. 8 Well.

A Okay.

Q You abandoned the Fusselman in 1987 and recompleted it, I believe it's sometime in April of '87, we moved up into the Penn? Do you have the production information from April of '87 current for the Penn oil production on a daily basis?

A I do have it plotted in my briefcase. Currently the well is producing about 2 barrels of oil -- this is the Lambirth No. 8 -- about .3 barrels of oil per day and 6 barrels of water per day. It is marginally economic or uneconomic and it needs to have something done to it and what we're proposing to our management is go back and get the Fusselman.

Q For this particular well what daily oil volume would make it economic?

A It depends on -- in this particular Penn well we have a very high gas/oil ratio, so that uplifts the economic limit. Normally it's about 1 to 2 barrels a day. We are right now getting by on the Lambirth No. 7 at 2 barrels a day and it's marginal.

Q At what point in time did the No. 8 Penn

production fall below 2 barrels of oil per day?

A I'm not sure.

Q Do you remember how long it's been uneconomic for you to operate the well?

A No, sir, I sure don't.

Q Thank you.

MR. LEMAY: Are there any additional questions of the witness? He may be excused.

Anyone going to sum up? First let me ask if there are any statements in the case or if anyone else has anything to say in Case Number 9511?

Are you ready to sum up?

MR. CARR: May it please the Commission, this case involves the waste of oil; the waste of oil that we submit will result if you grant Phillips' application and permit them to dispose of produced water in the Lambirth No. 6.

The reason for this is it's going to damage the reservoir because it doesn't stay where it's placed because of fracturing.

I think one of the most interesting things that happened here today is that those of us have been reading the transcripts of the prior cases and thinking about this for days, is that in the engineering presentation by Phillips fractures really were never men-

tioned at all in cross examination and after that time they were the hallmark engineering factor or geologic formation factor that controlled the remaining duration of this case.

It's curious when it's the issue in '81 and it's the issue last October, that it wasn't the issue here today for cross. The reason is it's a real problem for Phillips because the fractures are there. There's no question about that. The fractures are conduits through which injected fluids can move and no one knows where, and that's the whole crux of this problem.

They move and normal engineering principles apply in areas where there's been production because of the lower pressures there. Well, we have offsetting properties that produce. Some are quite close, some are not so close, but we are concerned that the fluids that are injected will migrate towards our properties, water out our wells, oil will be left in the ground, and this is waste and we're here simply because we believe that a valuable resource, something we believe we under the Oil and Gas Act are entitled at least to an opportunity to produce.

We're here because we believe we may lose that opportunity and therefore this case also involves correlative rights. It involves correlative rights because we want the opportunity to produce 25,000

barrels that we think is there that we can produce.

Now, we can talk about how many barrels they may be able to produce if they get the application granted and how many we may lose, but I submit to you that when you look at correlative rights you have to look at Enserch's correlative rights. You have to give us an opportunity to produce our fair share, not take it away because somebody else thinks that they can produce something more.

This case involves waste and it involves correlative rights, and it falls squarely within the enumeration of the powers of the Oil Conservation Division as set forth in Section 72-12, and that's where you are authorized to, and I quote, "prevent the premature and irregular encroachment of water or any other kind of water encroachment which reduces or tends to reduce the total ultimate recovery of crude petroleum oil or gas, or both oil and gas, from any pool."

What they're proposing, we submit, tends to reduce the ultimate recovery of oil that we believe we have a right to produce.

I think it's also important to remember that when Phillips comes before you, the burden of proof is on them and we submit to you on this record they have not proven that what they're going to do is not going

to water us out, to take away from us the opportunity to produce our reserves and therefore we submit the application simply must be denied.

In 1981, as you heard, Enserch came before this Commission and sought authority to dispose in the Rader No. 2. Phillips opposed. The application was denied.

Today's proposal, although the reserves are down, is virtually identical to that, but since that time we have abided by the orders of this Commission. We have gone out, we spent a million dollars, we've drilled a disposal well. We have laid a line. We've offered others the opportunity to participate; they did not. We did it at our cost. We have abided by the order of this Commission and we think it's time that Phillips starts doing the same, and to do that, you must deny their application.

Now Phillips says the reserves are lower now. That is true, but I think its extremely important to remember that when you act to protect correlative rights, or when you act to prevent the waste of oil, this isn't a question of degree, you must act to protect them, not just say, you get part, somebody else may get a little. But we think if you're going to do that, the decision is clear that the decision can only go one way. I

think it's important to remember when we talk about granting what they can get and denying what we can get, that it's not -- these two arguments don't just stand before you on the same footing because if you go against us, we submit our correlative rights are gone, the opportunity isn't there and we've lost the chance to produce recover- able oil.

If you deny the application, Ms. Courtright said there were other options that they could support. Now, back in 1981 the option they proposed was the Wolfcamp, why didn't we go try the Wolfcamp. Well, for various reasons nobody has tried the Wolfcamp. But we did go 10 miles north and we did develop. We think the time has come now on this record the application should be denied and they should be told they're going to have to move someplace else to dispose of this water and when you do that, you will have prevented the waste of oil, you will have afforded us an opportunity produce our just and fair share of the reserves, and you will have carried out your duties as enumerated by the Oil and Gas Act, and you will have, we submit, therefore met your statutory obligations.

MR. LEMAY: Thank you, Mr. Carr.

Mr. Kellahin?

MR. KELLAHIN: Thank you, Mr.

Chairman.

If this is a case that doesn't justify the use of a well for disposal of produced water back into the same formation in which that formation currently continues to produce hydrocarbons, then there isn't one. We might as well change the rules of the game and not come before you and waste our time.

This is a classic case by which this operator in every prudent way has justified the return of produced water back into that formation. It meets all the classic requirements for allowing that to happen. There's absolutely no reason from a sound point of conservation and prevention of waste not to approve the application.

It's down structure to all known producing perforations in the Fusselman. It is down structure to all future potential production in the Fusselman. There is not a geologist here today who has told you he could identify proven production in the Fusselman below the oil/water contact that we're going to be injecting into.

Mr. Halle has used careful and detailed geologic studies to find and determine the oil/water contact. It's undisputed that he was conservative.

Mr. Faigle came before you to-

day and he's more optimistic, he's got an oil/water contact that's up higher. We meet the condition of returning the produced water lower into the formation.

Can we do so without risk? Certainly. Ms. Courtright showed you that we aren't simply guessing on the ability of this disposal well to be perforated and take formation water.

Acting on the Commission -- the Division order entered in November, we perforated the proposed disposal perforations. They swabbed that well very diligently and carefully and couldn't get any hydrocarbons out of the zone; nothing; water, and that's all there is down there. There are no hydrocarbons at risk.

The question now that Mr. Carr wants to introduce for you, and their strategy has been, to have you believe that water injected at this rate on low pressure is going to migrate somewhere else and jeopardize their production, and he wants you to believe that his case now is like my case back in '81. I was there. I read the transcripts. I remember it differently.

Most lawyers do. My recollection is that the major point of concern for Enserch at this time was they needed a way to justify large volume of disposal in this well so that they would not jeopardize the direct offsetting production of Phillips, only 1,740 feet

away. The production at this time was a time of production in the reservoir where we had plush production; production in this very well up in the Lower Fusselman was 100 barrels of oil a day. There was nothing in here to keep that produced water from migrating directly to the flush production in the Phillips well and what they presented to this Commission, and which this Commission did not believe and accept, was their contention that they could perforate in the Montoya below the Lower Fusselman and keep that produced water in the Montoya, and the whole discussion in that case in 1981 had to do with the fact that the Montoya and the Lower Fusselman were fracture communicated. It was geologic nomenclature. There was no barrier between the two. And they tried hard, we fought for days over how -- how they were going to present that argument, and the Commission found and it's in the order, that fracture communicated between the Montoya and the Fusselman. That does not equate to the fact that we're going to dispose of water in the Lower Fusselman here and have it pipelined directly to the discovery Well No. 1 some mile away. That's not the case and that's not what's going to occur.

Ms. Courtright showed you on that step rate test, that's an interesting step rate test, you might want to examine it a little more carefully than we did this morning, it does not have a typical curve

breakover where you see part of the formation on vacuum. They can put water in that formation and not build up any pressure in that formation.

Mr. Brostuen talked to our witnesses about the 2.1 psi per foot of depth limitation. For the top perforations in this zone it's 1,475 pounds, give or take. We can't even approach that. It sucks it right into the formation. Those fractures are already there and we're not doing anything to them that's not already being done.

Water disposed of in this -- in this well is not going to directly communicate with the discovery well; it just doesn't make any sense.

When you examine the potential to disrupt known production offsetting the disposal well, we have ad infinitum today examined 7 and 8. Neither one are commercial. The operator has abandoned them. Now he tells us he's going to come back to them. I take that with a grain of salt. I suggest that you might too. They encroached those perforations then and they abandoned them back in '87 for the No. 8 Well. They're not going to come back and get that.

His economic analysis tells him he's going to be able to do that at 40 cents a barrel? We've offered him 15 cents a barrel. We're going to draw

on the economic life of his well if he really believes what he's telling us.

This is not a waste case. It's not a correlative rights case. It has nothing to do with those things, but it has everything to do with the opposition's effort to maintain and preserve an economic advantage in the reservoir and we don't think that's fair and it's not justified and we'd ask you to grant our application.

MR. LEMAY: Thank you, Mr. Kellahin.

Are there any further statements in this case?

If not, we shall take the case under advisement and the hearing is adjourned.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C. S. R. DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division (Commission) was reported by me; that the said transcript is a full, true and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

NEW MEXICO OIL CONSERVATION COMMISSION

COMMISSION HEARING

SANTA FE, NEW MEXICO

Hearing Date MARCH 9, 1989 Time: 9:00 A.M.

NAME	REPRESENTING	LOCATION
Larry Hastings	Enron Oil & Gas	Midland
Rick Halle	Phillips Petroleum	Odessa
Bill Mueller	Phillips Petr.	Odessa, TX
Susan Courtright	"	Santa Fe
W. Killahin	"	Santa Fe
Frank N. Pope, Jr.	Enserch Exploration, Inc	Dallas
Bob Hulen	Pogram	Santa Fe
William F. Carr	[illegible]	Santa Fe
Jane Gendley	Enserch Expl.	Midland
Leonard Kush	Enserch Expl. Inc	Midland
George Fayle	Enserch Explor.	Midland
Mark Ba[illegible]	Enserch Exploration	Midland
Lindsay D. Buchan	OCD	Santa Fe
Victor Lyon		

ILLEGIBLE

NEW MEXICO OIL CONSERVATION COMMISSION

COMMISSION HEARING

SANTA FE, NEW MEXICO

Hearing Date MARCH 9, 1989 Time: 9:00 A.M.

NAME	REPRESENTING	LOCATION

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO

16 February 1989

COMMISSION HEARING

IN THE MATTER OF:

In the matter of cases called on this date and continued or dismissed without testimony presented.

CASES
9511
9543
9544
9588
9490

BEFORE: William J. Lemay, Chairman
William M. Humphries, Commissioner
Erling Brostuen, Commissioner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Division: Robert G. Stovall
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico

For The Applicant:

I N D E X

MR. LEMAY; This hearing of the Oil Conservation Commission will come to order and we will now hear Case Number 9511.

MR. STOVALL: That's the application of Phillips Petroleum Company for salt water disposal, Roosevelt County, New Mexico.

They've requested this case be continued to March 9th, 1989.

MR. LEMAY: Without objection the case will be continued to the Commission docket on March 9th, 1989.

(Hearing concluded.)

MR. LEMAY: Case Number 9543.

MR. STOVALL: Application of Meridian Oil, Inc., for compulsory pooling, San Juan County, New Mexico.

Request that this case be continued to March 9th, 1989.

MR. LEMAY: Without objection Case 9543 will be continued to the March 9th Commission hearing.

(Hearing concluded.)

MR. LEMAY: Case Number 9544.

MR. STOVALL: Application of Meridian Oil, Inc., for compulsory pooling, San Juan County, New Mexico.

It's requested this case be continued to March 9th.

MR. LEMAY: Without objection Case 9544 will be continued to the Commission hearing on March 9.

(Hearing concluded.)

MR. LEMAY: Case Number 9588.

MR. STOVALL: Application of Sun Exploration and Production Company for contraction of the North Vacuum Atoka-Morrow Gas Pool; extension horizontally and vertically of the South Shoe Bar Atoka Gas Pool, and redesignation of said pool as the South Shoe Bar Atoka-Morrow Gas Pool, and the institution of proration in said pool as extended and redesignated, Lea County, New Mexico.

It's requested this case be continued to March 9th, 1989.

MR. LEMAY: Without objection Case 9490 will be continued to the Commission hearing on March the 9th.

(Hearing concluded.)

MR. LEMAY: Case Number 9490.

MR. STOVALL: Application of Texaco Producing, Inc., for compulsory pooling, Lea County, New Mexico.

It's requested that this case be continued to March 9th.

MR. LEMAY: Without objection Case 9490 will be continued to the Commission hearing on March 9th.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C. S. R. DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division (Commission) was reported by me; that the said transcript is a full, true and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO

19 January 1989

COMMISSION HEARING

IN THE MATTER OF:

Application of Phillips Petroleum Company for salt water disposal, Roosevelt County, New Mexico. CASE 9511

BEFORE: William M. Humphries, Commissioner
Erling Brostuen, Commissioner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Division: Robert G. Stovall
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico

MR. BROSTUEN: Call next Case Number 9511.

MR. STOVALL: Application of Phillips Petroleum Company for salt water disposal, Roosevelt County, New Mexico.

Applicant has requested this case be continued to the Commission hearing set for February 16th, 1989.

MR. BROSTUEN: Is there anyone present who would testify or appear in Case Number 9511?

Is there any objection to continuance to February 16th?

If not, we'll take it under advisement.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C. S. R. DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division (Commission) was reported by me; that the said transcript is a full, true and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR